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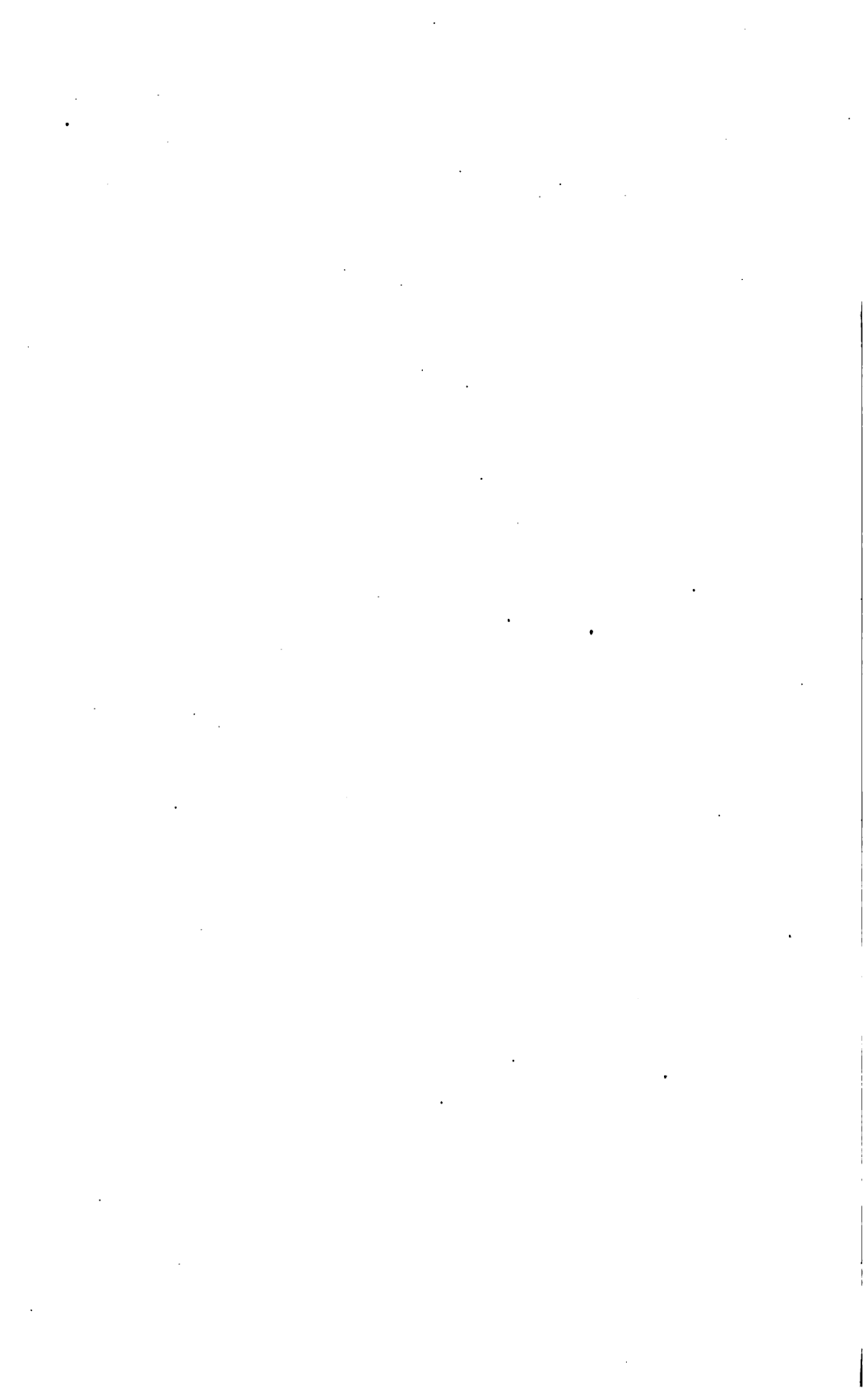


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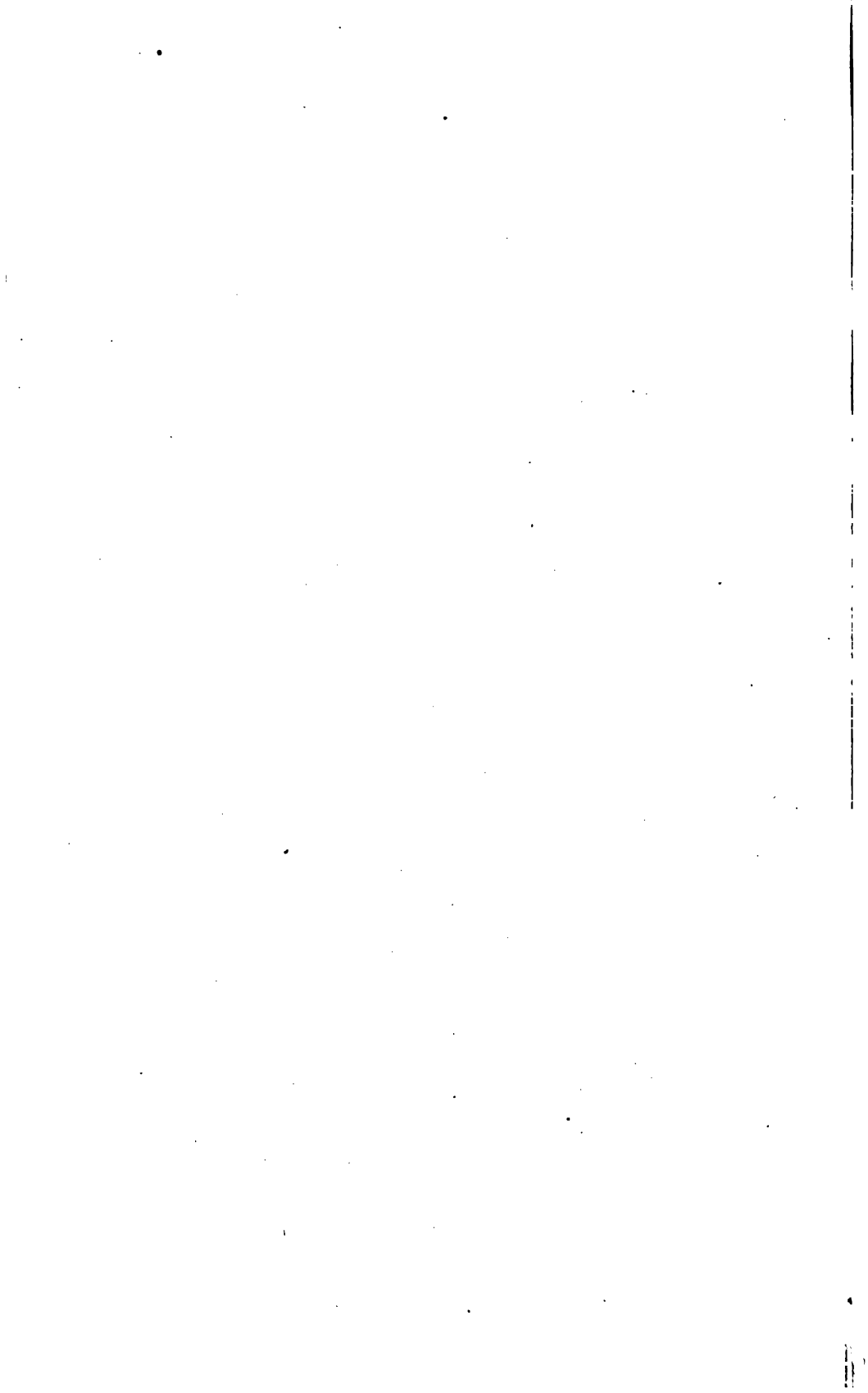
Book W6

1909









HEARINGS

BEFORE THE

COMMITTEE ON INTERSTATE
AND FOREIGN COMMERCE

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OF THE

HOUSE OF REPRESENTATIVES

ON

PANAMA CANAL

HOTEL TIVOLI, ANCON, CANAL ZONE
JANUARY 6 AND 7, 1909

WASHINGTON:

GOVERNMENT PRINTING OFFICE.

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PANAMA CANAL.

HEARING BEFORE THE COMMITTEE ON INTERSTATE AND FOREIGN
COMMERCE OF THE HOUSE OF REPRESENTATIVES.

HOTEL TIVOLI, ANCON, CANAL ZONE,
Wednesday, January 6, 1909.

The committee met at 8 o'clock a. m.

Present: Messrs. Hepburn (chairman), Stevens, Esch, Kennedy, Cushman, Hubbard, Knowland, Richardson, and Bartlett.

Also present, Col. George W. Goethals, U. S. Army; Col. H. F. Hodges, U. S. Army; Maj. D. D. Gaillard, U. S. Army; Maj. William L. Sibert, U. S. Army; Mr. H. H. Rousseau, civil engineer, U. S. Navy, members of the Isthmian Canal Commission; Mr. Joseph Bucklin Bishop, secretary of the Isthmian Canal Commission; Maj. C. A. Devol, U. S. Army; Maj. E. T. Wilson, U. S. Army; Maj. Chester Harding, U. S. Army; and others.

The CHAIRMAN. I suppose it is well understood that the type of the canal has been fixed by statute, and we are not here for the purpose of discussion or participating in a discussion of possible changes. Those must be first matters of law. We are here simply to secure some information whether or not the methods decided upon are being properly applied, and whether or not they will be probably successful.

I think it would be wise in this investigation if some one gentleman would conduct it, in part at least, without interruption. When he gets through, other gentlemen can ask such questions as they please, or, if they see proper, hand a note to the gentleman conducting the investigation.

(After informal discussion, the suggestion of the chairman was agreed to, and Mr. Stevens was chosen as the one to conduct that part of the investigation relating to locks and dams.)

STATEMENT OF MAJ. CHESTER HARDING, U. S. ARMY.

Mr. STEVENS. What is your name and official assignment on this work?

Major HARDING. Chester Harding, assistant division engineer, Atlantic Division.

Mr. STEVENS. Of what work are you in particular charge?

Major HARDING. Of the Gatun locks and dam.

Mr. STEVENS. What has been your previous experience in this line of work?

Major HARDING. The most of the experience in construction work that I have had was in the District of Columbia, where I was assistant to the Engineer Commissioner, in charge, among other things, of the division of building and construction throughout the District, and principally, in addition to that, the special charge, by presidential appointment, of the construction of the new District Building of the District of Columbia.

Mr. STEVENS. How long were you in charge of the construction of that building?

Major HARDING. Four and one-third years.

Mr. STEVENS. When were you relieved, and when did you come down here?

Major HARDING. I was relieved the latter part of July, 1907, and reported for duty to the chairman of the commission on the 2d of August, 1907.

Mr. STEVENS. Then you have been here nearly one and one-half years in charge of that part of the work?

Major HARDING. The first part of my work here was in charge of the locks only. The latter part of June, 1908, I was given charge of the dam, in addition to the charge of the locks.

Mr. STEVENS. So that you have given particular attention to this particular work, and submitted one report regarding it, which is published as a part of the Official Report of the Isthmian Canal Commission for the year 1908, beginning on page 121?

Major HARDING. I have not seen a copy of that annual report, but I did submit a report to the chairman, which I have heard is published therein.

(The chairman here announced that he had received a note signed by Hamilton Foley, reading "May I attend this hearing as a correspondent for the New York Herald?" The chairman announced that he did not think he should take the responsibility of personally deciding the matter, whereupon the committee went into executive session. It was decided that the hearing should be an open one, and thereupon it was continued as such.)

Mr. STEVENS. This report to which I have called your attention, known as "Appendix D" of the Report of the Commission for 1908, contains a drawing of profiles under walls showing materials underlying lock foundations. Was that prepared under your direction—you are responsible for it?

Major HARDING. Yes, sir.

Mr. STEVENS. Will you please inform the committee in simple language, and as concisely as possible, beginning with the lower lock, or duplicate locks, and state the foundation under the lower locks, going to the foundations of the higher lock and forebay?

Major HARDING. The walls of the lower lock for the entire length rest upon a rock which has been classed geologically as argillaceous sandstone.

Mr. STEVENS. Just state what that is right now.

Major HARDING. That argillaceous sandstone is a sedimentary rock containing fossils, which evidently has never been subjected to high temperatures; it is not metamorphic; it is not igneous; it is hard, compact, and durable, except when exposed to the air.

Mr. STEVENS. What is its action under water?

Major HARDING. It experiences no change under water at all.

Mr. STEVENS. Is it water bearing?

Major HARDING. In itself—in the body of the material itself—there is no water. There are fissures occurring in the material through which small quantities of water percolate.

Mr. STEVENS. There is a statement in some of the newspaper criticisms concerning the lock foundations that what you call "argillaceous sandstone" is a clay material, slippery and treacherous. What is the fact?

Major HARDING. The fact is that it is a rock, durable when not exposed to the atmosphere, that will sustain five or six times the pressures that will come upon it. Indeed, the ultimate bearing capacity of the argillaceous sandstone has never been determined by me from experiments, for the reason that it was obviously many times strong enough to bear the load to come upon it. I would not think of testing it for its bearing capacity any more than I would think of testing granite or other stone of that character for a pressure such as is usually put upon it.

Mr. STEVENS. Then the foundations of this lower lock will rest on this argillaceous sandstone?

Major HARDING. Yes, sir.

Mr. STEVENS. To what depth?

Major HARDING. As I recall it, in the neighborhood of 57 feet below zero in the side walls.

Mr. STEVENS. That is below sea level?

Major HARDING. Yes, sir.

Mr. STEVENS. What is its action under pressure of lock material that will be placed upon it?

Major HARDING. There will be no effect upon it at all.

Mr. STEVENS. Has that been tested?

Major HARDING. Yes; but not by me.

Mr. STEVENS. Are the records in the office of the commission?

Major HARDING. I presume so.

Mr. STEVENS. And included in previous reports?

Major HARDING. I think probably in the report of Mr. Howe, published last year.

Mr. STEVENS. Have those reports and tests been taken into consideration by you?

Major HARDING. I have not, in reference to the argillaceous sandstone, paid much attention to the fact that it has been tested, because it was obvious to my mind that the material was above suspicion.

Mr. STEVENS. Now, how far above the locks does this argillaceous sandstone extend for the purpose you have indicated; is it under all the foundations of the lower lock?

Major HARDING. Yes, sir.

Mr. STEVENS. What is the foundation of the next series of locks—the middle flight?

Major HARDING. It is of the same material for nearly all of its length. [He refers to diagram.] It is for the entire length of the middle lock, except for about 150 feet under the east wall of the middle lock.

Mr. STEVENS. What is the material there?

Major HARDING. The material there is a conglomerate.

Mr. STEVENS. Of what?

Major HARDING. It is of pebbles and some cementing material, which is in a hard, compact condition. The general appearance of the conglomerate is similar to that of concrete made of gravel.

Mr. STEVENS. What will be its action under the pressure of the weight of the locks to be placed upon it?

Major HARDING. There will be no effect.

Mr. STEVENS. Is it water bearing?

Major HARDING. There was indication in some of the borings made of a slight amount of water when we struck the conglomerate.

Mr. STEVENS. Is it soluble in water?

Major HARDING. No; I have seen no evidences of it.

Mr. STEVENS. How is it when exposed to the atmosphere?

Major HARDING. In my opinion, it is more durable when exposed to atmosphere than is argillaceous sandstone.

Mr. STEVENS. So you consider it a sufficient basis for the foundation for the locks?

Major HARDING. I consider it the best foundation material we have in the locks.

Mr. STEVENS. Is there any other material than argillaceous sandstone and this conglomerate in the foundation of the middle flight of locks?

Major HARDING. No, sir.

Mr. STEVENS. What is the material in the foundation for the upper flight of locks?

Major HARDING. That is in part argillaceous sandstone, part conglomerate, and part soft sandstone.

Mr. STEVENS. Have you ascertained the proportions of the parts of those materials—that is, what proportion is argillaceous sandstone, what proportion conglomerate, and what proportion soft sandstone?

Major HARDING. I can estimate the proportions by reference to this drawing. [Examines drawing.]

Mr. STEVENS. Please give us an estimate as close as you can.

Major HARDING. The east wall will rest for about one-third of its length on argillaceous sandstone. For slightly more than one-third of its length on conglomerate, and for the remainder of the distance upon soft sandstone.

Mr. STEVENS. What sort of material is that soft sandstone?

Major HARDING. It is not uniform material throughout the length of the locks. The soft sandstone under the lower part—the north end—of the upper lock is blue in color, and is of greater strength and bearing capacity than the soft sandstone that occurs south of that point, which is yellow in color; so that a distinction between the two classes of soft sandstone, the better and the poorer, is quite obvious from its appearance, the yellow sandstone being softer than the other.

Mr. STEVENS. What is the action of blue sandstone under water, air, and pressure, such as in this lock foundation?

Major HARDING. An actual test load of 500 pounds per square inch was made on the blue soft sandstone, which during the period of the test was exposed to the atmosphere, and from which the water was excluded. Under the test load of 500 pounds per square inch there was no settlement of the material.

Mr. STEVENS. What would be the load of the lock wall?

Major HARDING. The maximum pressure occurring per square inch under the most adverse conditions of loading, which conditions would be of a temporary character, is 250 pounds per square inch.

Mr. STEVENS. So there is a large limit of safety? The material has been tested to twice the maximum load that can be temporarily placed upon it without any settlement at all?

Major HARDING. Yes, sir.

Mr. STEVENS. Please continue your explanation as to the action of this material when exposed to air and water.

Major HARDING. The material when exposed to air shows disintegration and deterioration. Also, when a block of this material is forced from its position by means of a pick it becomes shattered and soft, so that you may take part of it and crumble it up between your fingers. As it occurs in situ, before you have disturbed it, it is difficult to remove with a pick. The material has been exposed to water for unknown centuries. It is found in its natural condition, wet, so that the effect of water may be inferred—that is, the effect is nothing at all. The effect of atmospheric influences upon it is as I have stated.

Mr. STEVENS. In the New York Herald of Monday, December 14, appears this statement [reads]:

"In many instances the Major calls the argillaceous sandstone "typical blue," which, in the vocabulary of geologists, means that it is clay of the most treacherous and slippery disposition. No geologist would call blue clay a fit substance upon which to erect a house of any size, let alone a structure of such weight as the Gatun dam will be when completed.

That is the substance which you have just described as blue sandstone?

Major HARDING. Yes, sir; argillaceous sandstone—argillaceous blue sandstone.

Mr. STEVENS. How deep is that sandstone in the upper lock foundation?

Major HARDING. One of the holes I drilled there went down 150 feet below sea level. This material was found throughout the length of that hole, below the stratum of soft sandstone.

Mr. STEVENS. So that, with your experience and tests, you consider it a safe foundation for the pressure and load that will be put upon it?

Major HARDING. I do.

Mr. STEVENS. And you would stake your reputation as an engineer and a constructing engineer that it is a safe foundation for the lock you will place upon it?

Major HARDING. Yes, sir.

Mr. STEVENS. What is the yellow material of which you informed us?

Major HARDING. The yellow material seems to have been formed in part by a deposit of volcanic tufa, a mixture of sand and volcanic ash. It is a yellow, light material which is of volcanic origin. That material changes gradually from soft sandstone into argillaceous sandstone with tufa mixed. The change is so gradual that it is impossible to draw a line and say above this line is soft sandstone and below this line is argillaceous with tufa mixed.

Mr. STEVENS. What do you propose to do with this yellow, soft sandstone in the lock foundation?

Major HARDING. I propose to test all parts that are, in my judgment, at all doubtful to at least twice the load that is to come upon them. If the material thus tested settles appreciably I would propose that that material should undoubtedly be removed and the removal continued until material sufficiently strong to stand the test without any question is reached. The extent of this material, both vertical and horizontal, is a matter of judgment pure and simple, and the question of whether it should be removed locally, the soft parts being taken out, or a general removal of everything, including the good and the bad, down to a certain level, is also a question of judgment.

Mr. STEVENS. When you remove the tufa and doubtful material, what will you put in its place?

Major HARDING. Concrete.

Mr. STEVENS. Just as a dentist plugs a tooth?

Major HARDING. Yes, sir.

Mr. STEVENS. So you propose to go to that depth and find a foundation which you are sure will prove safe for the load that will be placed upon it?

Major HARDING. I do.

Mr. STEVENS. What number and character of borings were made in this rock before so much excavation had been made?

Major HARDING. The borings were very numerous and were numbered consecutively up to eight or nine hundred. Some of those borings, made before the arrival of any of the present officials on the Isthmus, were made for the purpose of locating rock. They were rapidly made—there was demand for results—and, generally speaking, the investigation stopped when the borings reached the proposed level of the wall foundations. In order to supplement those borings there was a series of borings made, all of which are platted on this report, and those borings were extended down, as a general rule, at least 50 feet below the level of the foundation of the lock walls, the idea being to show that the material underneath formed a suitable foundation for the locks.

Mr. STEVENS. When these borings were made, were they charted on paper and lines drawn indicating the character and trend of the material to be found in the borings?

Major HARDING. Yes, sir.

Mr. STEVENS. And from those borings have you made calculation as to the kind and quantity of material that will be found when excavation is made?

Major HARDING. Yes, sir. The report of July last, which this profile accompanies, was based altogether upon the indications of the borings, and the succession of strata was platted according to those borings, with the single exception that this material called "soft sandstone" as developed in the borings, gave no indications of coherence. There was some question whether or not the sand contained any cementing material whatever. In order to remove any doubt on that score, a test pit was dug down in that material in the immediate vicinity of the lock site and the material so encountered in place. After the observations we made at the bottom of that pit we felt justified in classing this material as soft sandstone.

Mr. STEVENS. Now, as a result of these borings and drawings and calculations, you assume a certain character of material, and a certain trend of that material, would be found when you excavated?

Major HARDING. Yes, sir.

Mr. STEVENS. In what proportion have you found your calculations misleading and wrong?

Major HARDING. In not a single case.

Mr. STEVENS. Do I understand, then, not a single case has been found in the borings for those locks, calculated upon the many hundreds of borings, in which your calculations for the lock foundations have been wrong?

Major HARDING. Not a case at all in which there has been a change in classification. Almost to the inch, we might say, we have encountered conglomerate where these profiles have shown conglomerate, and we have encountered soft sandstone where the borings indicated soft sandstone. The character of the soft yellow sandstone was not predicted in the report. It was assumed that the soft sandstone was practically uniform, and the fact that the yellow sandstone was not as hard as the blue was not indicated.

Mr. STEVENS. The blue sandstone you regard as stable and strong, and any statements of anybody that it is treacherous and unsafe is not warranted by the fact?

Major HARDING. In my judgment, that is the case.

Mr. STEVENS. Now, please tell us what is the foundation that is found for the forebay?

Major HARDING. The forebay extends a distance of about 250 feet above the lift wall of the upper lock. At that point there is to be an emergency dam, which requires a massive masonry sill in order to resist the pressures that will come upon it. The walls of the forebay contain no lateral culverts for filling the forebay, as do the walls in the locks themselves, consequently there is nothing to fix any particular definite depth of the walls of the forebay, except that they should be down in suitable material. According to these borings the walls of the forebay were placed in soft sandstone on the east wall, in argillaceous sandstone mixed with tufa in the middle wall, and in conglomerate in the west wall.

Mr. STEVENS. Now, what do you do to get a proper foundation for that forebay?

Major HARDING. The only thing to do, in my opinion, in order to get a proper foundation is to remove from beneath the foundations a sufficient amount of doubtful material, the exact amount to be removed to be determined by actual test loads, until we get down to a foundation that will bear, without any question, twice the maximum load that is to come upon it.

Mr. STEVENS. Then that will be the basis of your construction from the lower end of the lower lock to the upper end of the forebay; that will be the uniform course of your procedure?

Major HARDING. Yes, sir; no matter what ultimate plan is carried out, it will rest upon the well-known engineering principle that material which is to bear a load should be known to safely sustain more than that load without any injurious settlement. It is all a question, no matter what the structure, of material to resist pressure. You build a house upon earth, or clay, or rock, and so long as the bearing capacity of the material is not exceeded the structure is entirely safe.

Mr. STEVENS. And you go to the extent of providing twice the strength?

Major HARDING. Yes; a bearing capacity of double the load to be placed upon it. In the case of the blue sandstone we tested it double; we did not go on and add weight, because it involves the handling of a large quantity of material and is unnecessary.

Mr. STEVENS. Supposing it does not bear under the test of double the load, what do you do?

Major HARDING. We find the actual settlement that occurs when we begin to load it—we see how much settlement is due to a load of 300 pounds, 350 pounds, and so on.

Mr. STEVENS. Will you use material that will not stand the test of double the load?

Major HARDING. I would not like to do it.

Mr. STEVENS. So far as you can see, will you do it?

Major HARDING. No, sir.

Mr. STEVENS. So your purpose is to require a double-load-bearing capacity of the load that will actually be placed upon it?

Major HARDING. Yes, sir.

Mr. STEVENS. I noticed on these plans, and on the face of the earth the other day, preparation for a curtain wall. What is that?

Major HARDING. The curtain wall has for its object the exclusion of water from beneath the lock foundation and floors. The presence of water under a head—under a pressure—beneath the foundation of the floors of the locks and the walls tends to cause an unbalanced pressure, and to blow up the floor—I do not mean in the way of an explosion, but to raise it from beneath, if long continued. In some of the softest of our materials, the curtain wall has for another object the prevention of any erosion due to currents of water that may flow under the foundation.

Mr. STEVENS. So you think this curtain wall will be adequate to protect the lock foundations from the erosion of water?

Major HARDING. I think so.

Mr. STEVENS. Is it necessary to do so?

Major HARDING. If it were a hundred thousand dollar job somewhere in the States, I do not believe one engineer in ten would put it in; but as this is a work of such cost and magnitude, I believe it is a proper insurance to take.

Mr. STEVENS. That is in the nature of insurance against damage?

Major HARDING. Yes, sir; I think we ought to have no risky engineering in connection with any portion of the work.

Mr. STEVENS. I read from an article in the Washington Post of Sunday, December 27, from an anonymous engineer whom it is claimed has given information to the Post [reads]:

It is discouraging to note that they all agree that the Gatun dam is a great mistake. The essence of the opinion is that, while the dam itself might be so constructed that it could be made to hold water, the surrounding hills, which form a continuation of the dam, are so pervious that it will be impossible to impound the flow of the Chagres or to imprison its waters into a lake. The fault is in the surrounding hills which form a continuation of the dam. These elevations are described as being so porous in character as to utterly prevent any impounding of the waters of the Chagres, the seepage being such that no considerable body of water could ever be impounded.

After reading that, what statement have you as to the effect of seepage from the surrounding hills on the lock foundation?

Major HARDING. I think it is an absurd anxiety to have. I do not think there is any danger whatsoever of any important seepage through any of the natural hills which we find around the area of

the lake. Personally, my observations of these confines of the lake are limited to the vicinity of Gatun. We have there, as I assume we have everywhere else, hills which are composed at the top of earth formed by decomposition of the underlying rock; underneath that, a succession of strata of rock—pretty nearly everywhere we find the argillaceous sandstone and a similar succession of the strata we find under the site of the locks. Now, the shortest distance across from the lake to the opposite side of the hill there at Gatun is about 900 feet, so that water getting into that hill and getting out in material quantities on the other side would have to cross that distance of 900 feet, would have to cross through the overlying material of clay, would have to cross through the water-bearing rock, whatever it may be, and finally get out on the other side. There is at the present time at Gatun, quite accidentally, a lake formed by a fill of the Panama Railroad, which is impounded up against a hill. The water in that lake is about reference plus 40—40 feet above sea level. It stays there at a pretty steady level. I infer from that we can form a lake with that material. Nobody has been over every square inch of the confines of the lake to be formed by the Gatun dam and can say no crevices exist here, there, or anywhere else, and it is impracticable for anybody in the course of centuries, I presume, to do that—to make that investigation; but I do not believe there is any danger whatsoever from that source, and I do not think it is a criticism or cause of anxiety that is worthy of any sleeplessness.

Mr. STEVENS. What will be the area of the lake?

Major HARDING. In the vicinity of 170 square miles.

Mr. STEVENS. So if a fissure or chasm existed in the hills sufficient to imperil the impounding of that large volume of water it would probably be discovered in the near future?

Major HARDING. If the loss of water was sufficient to prevent the rising of the water at the estimated rate, investigation would be made.

Mr. STEVENS. Do you know of any such being discovered?

Major HARDING. I have not seen any such manifestations. I have heard that investigations were made with reference to a place somewhere in the vicinity of San Pablo, where the material was very much shaken up, where it was said caverns existed, etc. That was during my absence from Gatun on leave, and an investigation of that vicinity was made by Major Sibert's direction.

Mr. STEVENS. Who would know about that personally and officially?

Major HARDING. Major Sibert.

Mr. STEVENS. I will ask one question more about the lock foundation. You state you were the engineer in charge of constructing the Municipal Building in Washington?

Major HARDING. Yes, sir.

Mr. STEVENS. You are familiar with the character and safety of the foundations of that building; how would the foundations of that building compare with the foundations as you expect to prepare and to have them for the Gatun locks?

Major HARDING. I should say that the factor of safety in the District building in Washington is less than obtains at the Gatun locks. The foundations are absolutely different in character. The foundations of the District building in Washington are all piles. They were driven until they resisted the load that comes upon them: they are loaded up to 25 tons to the pile.

Mr. STEVENS. So that, as a matter of professional and official opinion, you are willing to state, as a matter of record, that the factor of safety in the Gatun locks will be larger than the factor of safety in the Municipal Building in Washington?

Major HARDING. Yes, sir.

Mr. STEVENS. Now, as to the dam. There was a slide there the other day that has occasioned much discussion. Please state what that slide was, what in your opinion caused it, and what was its effect.

Major HARDING. This slide was a depression in a fill of rock that we had built in what is called the south toe of the dam. The purpose of the toes of the dam is for retaining walls, between which the main body of the dam will be built. They perform all the functions of a retaining wall. This fill had stood there for several months at about the height you saw it the other day, and apparently no change had occurred in it, until we began to pump out the water in the old French canal, to examine the bottom and clean it. When the water in the French canal had been lowered several feet, so that the water on the other side was about 20 feet higher than the water in the French canal, without much warning and in a short time—about five minutes—the settlement occurred as you gentlemen saw it the other day. That settlement consisted of a depression in the crest of the fill, and a horizontal motion toward the north and toward the middle of the dam. In my opinion, the cause of this settlement was the fact that the material on which the fill was placed is soft—about the consistency of putty—which tends to come out from under a load. It is impervious, but it is yielding to pressures, and when it can find an outlet can be squeezed out of position. The fact that the pressure on that side was removed when the water was pumped out disturbed the equilibrium which existed before, thus creating the condition which caused the settlement to occur.

Mr. STEVENS. Is that the only slip which has occurred in that vicinity?

Major HARDING. No, sir, there have been four or five.

Mr. STEVENS. What was the condition of the earth, or the structure on the other side, or just beyond the toe?

Major HARDING. On that side we had filled some 400 or 500 feet to about 30 feet below the level of the rock fill, with the idea of preventing spread of the soft material laterally in that direction. In other words, the material on that side of the dam was loaded down to such an extent it could not move. The other side was not so loaded, consequently the movement occurred in that direction.

Mr. STEVENS. Did the material on the other side of the ridge move?

Major HARDING. None at all at that time.

Mr. STEVENS. So that the slide that actually did occur did not move the material on the other side of that ridge?

Major HARDING. No, sir. It was an indication that the weight was sufficient to prevent motion on that side.

Mr. STEVENS. How far is the railroad track you were using from the depression that occurred in the rock ridge?

Major HARDING. The Panama Railroad?

Mr. STEVENS. No; I am speaking of the temporary line of track.

Major HARDING. That temporary line of track was 30 or 40 feet, I should say, from the point where the depression occurred.

Mr. STEVENS. Did that track move any on account of the slide?

Major HARDING. Yes, sir; it settled, and moved laterally. It settled, I should say, less than 10 feet, and moved laterally only 2 or 3 feet.

Mr. STEVENS. How much did it disturb your operations on that track?

Major HARDING. Not more than half a day. We did not pay much attention to it until we read about it later.

(The chairman announces that other gentlemen are at liberty to interrogate the witness.)

Mr. ESCH. Major, are not most stratified rocks porous, and hence water bearing?

Major HARDING. Yes, sir; I think that is true.

Mr. ESCH. Then soft sandstone is water bearing?

Major HARDING. It is.

Mr. ESCH. Have you by test determined the percentage of water in a cubic foot, for instance, or any other unit, under the formations of the upper lock?

Major HARDING. I have not. I have not weighed a specimen containing water, and then dried it out and found the percentage of loss.

Mr. ESCH. As a rule, there is some flow in all water-logged strata, is there not?

Major HARDING. Yes, sir.

Mr. ESCH. The greater the flow the greater possibility of washing out the binding or cementing material?

Major HARDING. Yes, sir.

Mr. ESCH. Have you determined the rate of flow in that soft sandstone?

Major HARDING. I have not, personally.

Mr. ESCH. Has it been done?

Major HARDING. It has been; it is a matter of official report.

Mr. ESCH. Have you the data with reference to that?

Major HARDING. I believe that is published in Mr. Saville's report in connection with the dam.

Mr. ESCH. Now, there is some flow in that material now?

Major HARDING. Yes, sir.

Mr. ESCH. Would that flow be augmented by a head of 85 feet of water?

Major HARDING. That is a matter very difficult to predetermine. There is a head of more than 85 feet of water in that material higher up in the hills toward the southeast, and in some places the water is found in that material at an elevation of over 100 feet above sea level. Now, my idea as to the source of supply of the perennial stream that flows through that material is, rain water that descends in those hills toward the southeast and gradually gets out toward the west. Now, as the water flows toward the west, of course there is a loss of head. The investigations I have made indicated quite clearly there was a flow of water through the lock site and out to sea. This head of 100 feet is at some distance from the site of the locks. The immediate presence next to the locks of a head of 85 feet would, of course, increase the head under the locks.

Mr. ESCH. And increase the rapidity of flow?

Major HARDING. Yes, sir.

Mr. ESCH. Those things can not be predetermined; but it is desirable to cut off the flow, or at least retard it?

Major HARDING. Yes, sir; I think that would be a wise precaution.

Mr. ESCH. Would it be possible to do either under the conditions you now have at the Gatun locks?

Major HARDING. I think it would be possible to diminish the flow of water under the lock site to practically nothing at all, so that the water will flow out to sea through outlets other than under the site of the locks.

Mr. ESCH. If there are fissures in this soft sandstone, that increases the rapidity of flow. Are there such?

Major HARDING. There are.

Mr. ESCH. Yet you think, with precautions, that flow can be reduced to a minimum?

Major HARDING. Yes, sir; I think it can be practically prevented.

Mr. ESCH. Then, if you prevent it, you prevent subsidence by reason of the washing out of the binding material?

Major HARDING. Yes, sir. Now, there is another point in connection with that that I would like to say something about. The fact that water has been for ages flowing through this material without causing any erosion that we have discovered is a clear indication to my mind that under present conditions there is no danger of erosion under our lock site. In order for material to erode there must be some outlet for it, and the erosion that occurs and is referred to in my report in connection with the tests occurred where there was an outlet.

Mr. ESCH. But the unknown factor is, how much the flow would be increased by a head of 85 feet of water?

Major HARDING. That is purely conjectural.

Mr. ESCH. Is there any way of determining it?

Major HARDING. No satisfactory experimental way that I can think of; we can figure safe on it.

Mr. ESCH. As demonstrated by your model dam?

Major HARDING. No; that is different material altogether.

Mr. ESCH. Do you, in your experiments, determine that the flow is more largely through fissures in the material than through the mass?

Major HARDING. The quantity of water in motion is very small in any event under present conditions. The excavation we saw there yesterday of such depth, in a country with such excessive rainfall, appears to me remarkably dry. I anticipated a great deal more trouble with water in making excavation than I have found.

Mr. ESCH. Are fissures only due to seismic disturbances?

Major HARDING. Locally they are due to blasting, but the extent of the effects of blasting, I think, would be quite limited.

Mr. ESCH. These fissures are so far below the surface they could not be due to your blasting?

Major HARDING. We do not know how far they go.

Mr. ESCH. Have you determined, or did the French determine, the degree of seismic disturbances on the Isthmus?

Major HARDING. I know very little about that personally. I have read that there have been no appreciable seismic disturbances for over a century.

Mr. ESCH. So you do not anticipate any weakening of the canal structure, including the locks, from such causes?

Major HARDING. Well, I do not know whether we are going to have an earthquake or not.

Mr. ESCH. I understand the original plan was to have the dam 135 feet high?

Major HARDING. Yes, sir.

Mr. ESCH. It is now contemplated to build it only 105 feet high?

Major HARDING. There was a proposition to that effect, to which I subscribed—to reduce the height to 105 feet instead of 135 feet.

Mr. ESCH. Would that diminution in height lessen the security of the structure?

Major HARDING. I think it may possibly increase the stability of the structure.

Mr. ESCH. Explain that, please.

Major HARDING. The weight of the material that is going to form the dam has been measured, and it gives a pressure at the bottom of a ton to the square foot for every 20 feet in height; so, if we lower the level of the crest of the dam 20 feet we take off a ton to the square foot of the base of the dam underlying the part that is taken off. In other words, the pressure on the foundation of the dam will be a ton less per square foot than it is at the present time. The crest, 105 feet high, is 20 feet higher than the maximum level of the lake; it is 15 feet higher than the lock walls or lock gates; and it is higher than some of the natural hills that form the limits of the lake. The height of 20 feet above the lake is certainly ample to take care of any wave action that might occur. The horizontal dimensions of the dam, if the height is reduced 20 feet, would remain the same as they were before. The final 20 feet in the dam would cost more than the rest of it per unit, and I can conceive no useful effect of that excessive height, unless it be to provide a margin of safety to take care of any settlement that it may be anticipated will hereafter occur.

Mr. ESCH. So that a settlement of 5 feet, or 10 feet, or 15 feet will not cause a total destruction of the dam?

Major HARDING. In the process of construction of this dam, which will take several years to complete, it is my judgment we will probably get all the settlement we are going to get.

Mr. ESCH. So that the height has practically been determined upon?

Major HARDING. I could not say definitely as to that.

Mr. ESCH. Now, in the surrounding hills which will form the confines of the lake, there are two depressions or saddles, are there not, one being the Trinidad; how high are those saddles above the lake level?

Major HARDING. I know very little about the Trinidad saddle; I have never seen it personally.

Mr. ESCH. Have any borings been made along there to determine the character of the underlying formation?

Major HARDING. I do not know; that has not been within my sphere.

Mr. CUSHMAN. Major, I understood you to say borings had been made by officials previous to those now in charge. Are you familiar with those borings?

Major HARDING. I have seen the records of them, and some of the samples.

Mr. CUSHMAN. Who made those borings?

Major HARDING. Some of them were made under the immediate direction of Mr. Nichols, who is at present an engineer employed under the commission. I think, probably, most of them were made under his direction.

Mr. CUSHMAN. Have you examined all the borings made there?

Major HARDING. I have examined all of them that have any bearing whatsoever on the lock work. I have not as complete a knowledge of the borings and experimental data relating to the dam as of the locks.

Mr. CUSHMAN. Under the present administration, have you bored deeper than any other borings made?

Major HARDING. We have.

Mr. CUSHMAN. What is the depth of the borings made previous to the present administration?

Major HARDING. On the site of the locks those borings stopped when they reached the level of the foundations of the walls. The underlying object, apparently, was to determine the location of rock, and to determine whether or not the lock walls, as proposed, would rest upon rock. When we had time to more thoroughly investigate the matter we did so by determining what underlay the rock we encountered.

Mr. CUSHMAN. Do you think they stopped because they thought the foundation was insufficient?

Major HARDING. No, sir; I never heard that.

Mr. CUSHMAN. Were borings made under the administration of Mr. Stevens; how far did he go?

Major HARDING. Those were the borings I have in mind with reference to the Gatun locks. There is a record of those borings there—I can not say whether they were made under Mr. Stevens' administration or Mr. Wallace's administration. The records show the character of the material and the depth of the borings; but why they made the borings and why they stopped are things not shown by the record.

Mr. CUSHMAN. Is there any difference in the character of material found?

Major HARDING. I do not think there is any difference in the character of the material; I think there is a difference in the naming. Argillaceous sandstone, for instance, was formerly classified as indurated clay.

Mr. CUSHMAN. What was the depth of the borings made under the French administration?

Major HARDING. I do not know that, sir.

Mr. BARTLETT. In reference to the slide you spoke of, what effect did it have on the bottom of the canal?

Major HARDING. For possibly 100 feet, maybe less, from the fill there was a slipping of the material and an uprising of the bottom and displacement of the rock for that distance.

Mr. BARTLETT. What did that indicate?

Major HARDING. That indicated a horizontal movement of the material, due to the fact that the equilibrium of the mass of the material had been disturbed by the pumping out of the old French canal.

Mr. BARTLETT. You have read some accounts, doubtless, that there was evidence of some subterranean stream beneath the lock site?

Major HARDING. I have never heard or seen anything at all on which such statements could be based. I know there is no such stream as well as I know anything.

Mr. BARTLETT. The slide then was caused by the fact that the pressure in the canal had been removed from the lower side. Was there any evidence on the upper side?

Major HARDING. There was no evidence of any movement of material toward the south—all motion was toward the north. The reason was that the weight of material south was sufficient to prevent any motion.

Mr. KNOWLAND. Some reference has been made to the probable effect of earthquake disturbance on the dam. Are you familiar with the San Leandro dam in California?

Major HARDING. No, sir.

Mr. KNOWLAND. That dam, as I recall, is about 120 feet in height. I believe it is one of the highest dams in the country at the present time. Now, we had quite a little shake in California a few years ago, and a very close examination of that dam disclosed the fact that no damage whatever had resulted. So, do you not think that would tend to lessen the probability of like damage resulting here?

Major HARDING. Yes, sir. I think undoubtedly an earthen dam of such huge proportions would be affected by an earthquake very much as a natural hill is affected by an earthquake. In other words, a moderate shake would have no effect at all.

Mr. HUBBARD. With reference to the foundations for the lock walls—I am not sure your statement extended to all the walls; I think you confined yourself to the east wall—is what you said applicable, also, to the foundations under the middle and west walls? I am speaking only of the pair of lower locks.

Major HARDING. Yes, sir. The foundations of the walls on both sides of both locks are of undoubted strength.

Mr. HUBBARD. Are they of argillaceous sandstone throughout?

Major HARDING. Yes, sir.

Mr. HUBBARD. Upon what will the walls of the middle pair of locks be founded?

Major HARDING. The wall of the middle lock on the west side rests entirely in the argillaceous sandstone. The east wall, part of it, rests on conglomerate.

Mr. HUBBARD. Is that due to a break in the stratum?

Major HARDING. It is due to a dip in the strata—there is a very marked dip in the strata to the north.

Mr. HUBBARD. About what is the angle of that dip?

Major HARDING. It is not more than four or five degrees, I should say.

Mr. HUBBARD. Will you speak in regard to the three walls, which part rests on the argillaceous sandstone, which part on the conglomerate, and which part on the soft sandstone?

Major HARDING. In the upper lock, with reference to the east wall, I think I made a definite statement; I will repeat it. About one-third rests in argillaceous sandstone, a little more than one-third in conglomerate, and the remainder in soft sandstone.

Mr. HUBBARD. Now as to the other wall?

Major HARDING. In the middle wall about three-quarters in argillaceous sandstone, about one-eighth in conglomerate, and the remainder in soft sandstone. Under the west wall more than half of it is in argillaceous sandstone, about one-eighth of it is in conglomerate, and the remainder in soft sandstone.

Mr. HUBBARD. Will you state a little more fully the precautions you contemplate against the subterranean flow of water?

Major HARDING. The precautions that I would propose to take with reference to the locks would be made entirely for the protection of the lock foundations, and have nothing at all to do with the prevention of seepage from the lake. In order to protect the foundations of the locks from danger due to the passage of underground water, I would propose to surround the material underlying the upper lock with a concrete wall, extending down a distance which it is impracticable to state until we get there, but whose maximum depth would be down to the line drawn in these sections where argillaceous sandstone without the mixture of tufa occurs. That wall would extend entirely across the head of the lock, down the east wall of the lock, until we have a thickness of material overlying the soft sandstone which is capable of resisting any upward pressure that might occur at that point; extending that wall across the locks until it joins the west wall, and then extending it back, up the west wall, until it makes a complete box, you might call it, inclosing and shutting off the water from the material underlying the foundations.

Mr. HUBBARD. That done, you are absolutely confident that no water would reach this lock site?

Major HARDING. No, sir; I am not. I think the amount of water that would reach the lock site would be inappreciable, or rather, such a small quantity as would do no harm either as a pressure or as a scouring agent.

Mr. HUBBARD. But you would be absolutely confident of the safety of the structure so far as that was concerned?

Major HARDING. I would; yes sir.

Mr. HUBBARD. Is that the curtain wall of which you spoke a while ago?

Major HARDING. Yes, sir.

STATEMENT OF MAJ. W. L. SIBERT, U. S. ARMY.

Mr. STEVENS. What is your position, Major, in the Canal Commission and its work?

Major SIBERT. I am a member of the Isthmian Canal Commission and at present in charge of the work in the Atlantic division. This work includes the construction of the Gatun locks and dams, the excavation of the sea-level portion of the canal in that end, and the construction of any works necessary in Colon Harbor.

Mr. STEVENS. What experience have you had in dam construction?

Major SIBERT. From 1887 to 1892 I was assistant engineer. I had local charge of lock and dam work on the Kentucky River and Green and Barren rivers, and from 1892 to 1894 I was assistant under General Poe in Detroit and had something to do with the 800-foot lock at the Soo, especially in the preparation of the floor system for that lock. From 1894 to 1898 I had charge of a river and harbor district

in Arkansas. My duties there were largely in the regularization of streams, in shaping the channel properly. I also had to do with the project for improving the White River by locks and dams. From 1898 to 1899 I was on duty in the Engineering School of Application as instructor. From 1899 to 1900 I was on duty in the Philippines as chief engineer of the Eighth Army Corps, and from 1900 to 1901 I had charge of a river and harbor district headquarters at Louisville, Ky. This work included the Louisville and Portland Canal, and Green and Barren rivers, which involved locks and dams, also a lock on the Wabash River. From December, 1901, to March, 1907, I had charge of the river and harbor work near Pittsburg, which included the construction of 5 locks and dams in the Ohio River, 10 in the Monongahela River, and 3 in the Allegheny River.

Mr. STEVENS. When did you come to the Commission?

Major SIBERT. I left the United States March 10, 1907.

Mr. STEVENS. Since that time you have had charge of lock and dam construction at Gatun?

Major SIBERT. Yes; I had charge of all lock and dam construction on the canal until last July, when the work was divided according to territory and not according to class of work.

Mr. STEVENS. Have you had experience in the construction of earth dams?

Major SIBERT. No, sir; except earthen cofferdams, which are dams to keep water out of inclosures while you are doing other work.

Mr. STEVENS. You have had much experience in the handling of cement in the construction of locks and dams?

Major SIBERT. Yes, sir, generally.

Mr. STEVENS. Will you state to the committee the plan of the construction of the Gatun dam, exclusive of the locks?

Major SIBERT. The dam is to be constructed by what is known as the hydraulic method; that is, the material is to be pumped into the dam and distributed by water. As the current, after leaving the discharge pipe, is decreased, the material is deposited from the water and is distributed by the flow of the water. There will be in this dam, as it is being built, a low place in which the water will stand longest, and in which the finest material will be deposited; this place will constitute the more impermeable part of the dam. The water there will be allowed to stand at some depth that will be determined as we go along. This depth will be such as to insure the settling in the dam of practically all the material that was brought into it by the hydraulic dredges. The water, after it has deposited its material, will be drawn off and carried outside of the dam. That is the general thought about it.

Mr. STEVENS. That constitutes the mass of the dam?

Major SIBERT. That constitutes the superstructure of the dam. If we build to the full height of 135 feet—that is, 50 feet above lake level—20 or 30 feet possibly of this material might be hauled in by trains. But the construction of the dam to a safe height above lake level is to be done by hydraulic dredges, which I have spoken of already.

Mr. STEVENS. Will you give the purposes of the toes of the dam from an engineering standpoint?

Major SIBERT. The first object of the toe was to prevent slipping within the dam itself—that is, slipping of material put in. For

instance, take the upper slope of that dam as at 1 on 3; if that becomes perfectly saturated it might slip within itself. To prevent this, it was decided to make the upper slope flatter, and a rock toe or ridge 50 to 60 feet high was planned to accomplish this. This rock toe would act as a buttress or retaining wall for the upper or lake slope of the dam. From the top of this toe to the top of the dam a flatter slope could be made and the upper face of the dam itself rendered less liable to slip in consequence of its own saturation. As the work progressed, and especially after these slips, the idea of extending this toe farther and farther upstream or into the lake, to prevent the displacement of any material, in case it became overloaded, also grew, and this toe, so called, is being extended as far into the lake as the material available will permit. A toe for similar work is being built at the north side of the dam.

Mr. STEVENS. What is to be the slope of the north side of the dam?

Major SIBERT. About 1 on 11—that is, 1 vertical to 11 horizontal is the present plan.

Mr. STEVENS. Do you make it so steep in order that there may be greater capacity for silt or to prevent slipping of material?

Major SIBERT. The flatter it is the less apt the material is to slip. The flatness of it also gives a greater depth of material overlying any yielding material and would prevent this yielding material from breaking up through the lower slope in case it were overloaded. In other words, it balances better the maximum pressure under the highest part of the dam.

Mr. STEVENS. What do you intend making the width of the slope of the south side of the south toe going into the lake?

Major SIBERT. The width of this overlying material?

Mr. STEVENS. Yes, sir.

Major SIBERT. That has not been definitely determined. We expect to use all the material that we have. We have kept that up as a dump.

Mr. STEVENS. So there is no limit to that?

Major SIBERT. There is no limit. Should anything develop to show that it was not extended far enough, we might extend it by dredging, or we might excavate material out of the hills.

Mr. STEVENS. Would the putting of such a mass of heavy material on such a soft base tend to increase the pressure underneath the dam?

Major SIBERT. The higher you build the dam the greater the pressure on the base, and consequently the greater the tendency for the underlying material to move from under the load. The dam could not settle unless this material can go somewhere, and if we so balance the loads for the dam proper and for the toes and their extensions that this material can find no place to go, if overloaded, then there should be no material settlement.

Mr. STEVENS. Do you contemplate using a similar method with reference to the north toe?

Major SIBERT. Yes, sir.

Mr. STEVENS. What is the gradient of the slope of the north toe toward Gatun?

Major SIBERT. At present that is simply being put in there as a dump. It is practically horizontal and about 20 feet thick overlying the natural ground, and that is being extended from material excavated from Mindi and Gatun locks.

Mr. STEVENS. Was there any preparation of the surface of the soil made before you put in the toes?

Major SIBERT. No, sir. Trestles were driven and dumps made from these trestles.

Mr. STEVENS. The vegetation was left?

Major SIBERT. None was removed; it was considered outside the impermeable dam. Its function was to act as a counterweight.

Mr. STEVENS. How about the diversions—the old French canal and the Chagres River?

Major SIBERT. We pumped out of the Chagres and canal and will pump out of the west diversion all silt deposited by the streams, so as to get down to the original geological formation, and allow the superstructure of the dam to come in direct contact with this material.

Mr. STEVENS. Then this slide took place in the French canal?

Major SIBERT. We have had several slides.

Mr. STEVENS. The large one—now, would it not have been more reasonable to expect this slide in the channel of the old Charges River?

Major SIBERT. Not if you examine the profile. There is underlying this dam a stratum of dark-blue clay of various degrees of consistency. In some places it is quite soft, and in some places harder. Overlying that is a stratum of a yellow mixture of sand and clay of varying thickness. In some places this blue clay is at sea level. In some places it is in the neighborhood of 70 feet below sea level. The thickness of the overlying sand and clay varies accordingly. That is about the general condition. The material upon which the slip occurred in the French canal is much nearer the surface than such material is under the Chagres River. There were some little subsidences in crossing the Chagres, but not such as had occurred in crossing the French canal.

Mr. STEVENS. You have not had any slip in the north toe?

Major SIBERT. Yes; a good many small ones.

Mr. STEVENS. And you anticipate more as the work increases?

Major SIBERT. That would be the natural assumption. There is quite a soft place at that end, and there have been considerable gradual subsidences, and the tracks have to be raised to keep up to level.

Mr. STEVENS. What preparation of the earth have you made between the toes?

Major SIBERT. We are now preparing for that. We are removing 2 feet of top soil, which is expected to take out the grass, weeds, and roots only. The material is good and is the same material out of which we expect to build the dam. We simply want to make a good connection.

Mr. STEVENS. You have very good material for your fill, have you not, in close proximity to the dam?

Major SIBERT. Yes; we have excellent material for the fill.

Mr. STEVENS. As shown by your model dam?

Major SIBERT. Yes, sir.

Mr. STEVENS. In the Chagres Valley, where the Gatun dam is to be constructed, the borings you made disclosed two gorges of considerable depth?

Major SIBERT. Yes, sir.

Mr. STEVENS. What do they indicate?

Major SIBERT. The geologists tell us that the country there has been uplifted at least three times; one time for over 300 feet, and

that rather suddenly. While at that height the Chagres River, or the Gatuncillo or Trinidad River, cut through, thus forming these ancient geological gorges. After they were cut, the country subsided again, approximately as much as it had come up, and lowered the beds of these streams until they were 200 to 260 feet below sea level. These gorges were filled partially by material that was brought down by the Chagres River and partly as a sea deposit, depending upon the rate at which this lowering occurred. If it lowered suddenly, the sea would probably come in and we would get a blue clay deposit. Above that, the deposit was brought down by the Chagres River.

Mr. STEVENS. What danger, if any, is there of underground seepage through these gorges after the dam has been constructed?

Major SIBERT. I do not anticipate any danger from that source.

Mr. STEVENS. Notwithstanding a pressure of 85 feet of head?

Major SIBERT. This blue clay is quite impermeable.

Mr. STEVENS. How far is that blue clay below the present surface?

Major SIBERT. It varies in depth from about sea level to 70 feet below. It may vary in other ways that I do not know of.

Mr. STEVENS. Do you expect to go down that depth to reach blue clay in the putting in of sheet piling?

Major SIBERT. It is expected to connect this blue clay by a line of sheet piling with the superstructure of the dam that we propose to build by the hydraulic method.

Mr. STEVENS. And you can get down in a practical way 70 feet below the surface and put in sheet piling?

Major SIBERT. Yes, sir. We expect to dig a trench 20 feet below sea level. The bottom of the river is about 15 feet below. Then we will drive 50-foot sheet piling in the bottom of that excavation and then carry it up in the dry until we get 5 feet above sea.

Mr. STEVENS. What is the width of each gorge at the surface?

Major SIBERT. That is shown definitely in the profile of the dam published in the annual report; about half of it, I guess. It is a wide gorge between Spillway Hill and the lock. The other gorge is narrow and joins on to the hills on the west.

Mr. STEVENS. Will you explain what method of sheet piling you are to use?

Major SIBERT. We will use wooden piling, triple lapped.

Mr. STEVENS. What system?

Major SIBERT. The Wakefield system; it is like a tongue and groove in a floor.

Mr. STEVENS. In your opinion, that would make an impervious barrier for the flow; in other words, through the gorges and intervals?

Major SIBERT. Yes; it makes an impervious barrier from the blue clay up to the superstructure that we propose to put on. Below the blue clay we have to depend on the material as it exists naturally. Down in the bottom of the gorges there is material that might be water bearing if there was a continuous line of it and water could get to it. We have no information that there is a material amount of water passing through it or that water can get to it from the lake. We struck artesian water with a head of from 8 to 10 feet above sea, but we can get no proof that there is any material amount of water flowing through there.

Mr. STEVENS. You constructed a shaft just west of the spillway; please give us the purpose of that shaft, and let us know the lessons it teaches, if any.

Major SIBERT. That was primarily constructed to determine the nature and character of the rock in the spillway. It was afterwards used in a test to determine the question of whether a head was liable to be transmitted through the small crevices in these rocks, and incidentally to get some information, if possible, about the leakage through these rocks; that is, it was filled after it was built to a height of 35 feet above the sea by water from a water tank on the hill, and the results were observed.

Mr. STEVENS. Did you try to fill in water and then pump out the water and note the effect on the other test holes in the vicinity?

Major SIBERT. Yes; in excavating this pit it was necessary to keep it unwatered, and that, of course, would give an indication of its effect on holes in the vicinity, but we observed less systematically there than at the locks. The geological strata in Spillway Hill are practically the same as those in the locks; in other words, the same geological stratum was cut into by these gorges.

Mr. STEVENS. Did you find a good foundation for the walls of the spillway?

Major SIBERT. Yes, sir.

Mr. STEVENS. What is the formation?

Major SIBERT. Argillaceous sandstone.

Mr. STEVENS. And you did not find softer stone and tufa?

Major SIBERT. The same material is there, but lower down. We did not have to go so deep for the foundation of these walls as in the locks.

Mr. STEVENS. What is the height of the miter sill of the spillway above sea level?

Major SIBERT. The miter sill applies to the locks only. The height of the foundation would be the point you are after. The spillway itself would not have been excavated to anything near the depth it is now had it not been necessary to use it as a diversion channel for the Chagres while we were building the dam between the hills; but the depth of that excavation was fixed by the probable height the Chagres River would attain during floods, and we dug it down. It is now 8 feet above sea level. We figure that when the Chagres goes through there, it will not attain such a height as to interfere with our work, and we will ultimately build a concrete dam across founded on this 8-foot elevation. The top of the concrete will be about 16 feet below the lake level, and on the top of the concrete dam we purpose placing regulating works which will control the water in the lake.

Mr. STEVENS. Then you see no element of unsafety in the construction of the spillway?

Major SIBERT. No, sir. We purpose to blanket all that hill; to excavate on the south face of the hill until we have passed through the strata that carry water the most, and to cover that face with concrete and let that join on to the sheet piling, and then we purpose to cover with concrete all exposed rock surface to which the lake will have access, so that no water can get into this rock; and we purpose to blanket the south face of Spillway Hill with impermeable

material, pumping it there as in the dam, thus practically shutting off the lake from this hill. It is a small hill isolated by these gorges.

Mr. STEVENS. How far will this sheet piling be north of the south toe?

Major SIBERT. North of the south toe? The sheet piling comes directly under the center of the dam.

Mr. STEVENS. I mean the center of the high part of the dam. It will be nearer the south edge?

Major SIBERT. Yes, sir. The dam is practically horizontal and 100 feet wide on top, and under the high flat part in the center comes the sheet piling.

Mr. STEVENS. In pumping out the shaft at the spillway, what effect had it in lowering the level in the test holes along the dam?

Major SIBERT. There was one hole in the spillway that was artesian and about 640 feet away from the test pit. We made no systematic observation, but when we pumped out the test pit the flow stopped in the artesian hole, which showed the connection.

Mr. STEVENS. What was the remotest test pit from the shaft that was affected by the pumping-out process?

Major SIBERT. That was the only one observed. We carried on systematic testing on that line at the locks. There the effect was noticed as far as 2,000 feet away.

Mr. STEVENS. Was that test hole east or west or north or south of the shaft?

Major SIBERT. North of the shaft. It lowered the water in the holes in every direction, but we had the longest line of holes in the direction of the lock, north to south.

Mr. STEVENS. That would indicate the connection of all the test pits with the shaft?

Major SIBERT. Yes, sir.

Mr. STEVENS. That connection, you think, was through fissures or the waterlogged mass of material?

Major SIBERT. I think principally and almost entirely through small fissures.

Mr. STEVENS. Of course your pumping-out process hastened the flow?

Major SIBERT. Toward the pit—yes, sir.

Mr. STEVENS. You believe that when the dam is completed, as you now plan it, the underground flow will be practically eliminated, if not stopped?

Major SIBERT. You mean the dam or the lock?

Mr. STEVENS. Well, both.

Major SIBERT. I think the underground flow under the locks will be increased somewhat when the lock is finished.

Mr. STEVENS. By reason of the head?

Major SIBERT. Yes, sir, by reason of the head. If that water gets no outlet anywhere, I do not see how it can do any harm. It has been traveling that way for centuries through these crevices. If it can not get any outlet nearer than its present outlet, which is undoubtedly in the sea, the distance will be so great that the head will be so reduced, as it has been for ages past, that there can be no enlargement of the fissures. If it has an outlet, I would expect some scour, as has been seen in the test pit dug at the locks in the soft sandstone of the black variety.

Mr. STEVENS. What was the rapidity of the flow in the test pit?

Major SIBERT. We got, I think, between 38,000 and 40,000 gallons per day.

Mr. STEVENS. What was the diameter of it?

Major SIBERT. About 6 feet square—maybe a little larger; big enough to go into and to excavate by hand.

Mr. STEVENS. With the method of cut-off of the underground flow, due to a head of 85 feet, as described by Major Harding, will you have reduced the underground flow to a point where it would not endanger the foundations of your locks?

Major SIBERT. Personally, I do not think it practicable to cut off this flow entirely, because we do not know the depth of these fissures, and consequently we do not know for certain that we can keep the pressure of the lake from under our lock floors by the curtain wall. I think the flow of water under the lock foundations would be diminished, but I do not feel certain that we would not get a head of water under the floors with this curtain wall.

Mr. STEVENS. Do you think whatever flow remains after all these precautions have been taken will in any degree lessen the security of your lock and dam?

Major SIBERT. If the water does not break up the floor and make an outlet. If it does that I would not feel sure.

Mr. STEVENS. What do you mean by breaking up the floor?

Major SIBERT. If the pressure due to the head of water in the lake under these floors were sufficient to break the floor, there would then be an outlet for the lake water to come into the lock, but the main part of this flow would be reduced by these curtain walls, but I would not feel sure that it might not disturb some of the soft sandstone.

Mr. STEVENS. What is the contemplated thickness of the floors?

Major SIBERT. The question has not yet been decided. It is still an open question.

Mr. STEVENS. Can any test be made to determine what thickness is required?

Major SIBERT. No, sir; you can only assume pressures you are liable to get. It is merely an assumption. We know that it can not be more than that due to an 85-foot head.

Mr. STEVENS. If there is no friction whatever?

Major SIBERT. Yes; that is the maximum.

Mr. STEVENS. How thick a floor would be required to safeguard against the maximum pressure?

Major SIBERT. If it were built as an arch, it would take a floor of from 9 to 11 feet thick.

Mr. STEVENS. Then you are going on a theory of a coefficient of safety of 2—double?

Major SIBERT. I hardly think that is enough myself. I think it is lower than the factor of safety that should be taken.

Mr. STEVENS. Now, then, if the pressure is liable to burst up the floor of the lock, is there not something in the material which may crack—like cement?

Major SIBERT. In what material?

Mr. STEVENS. In cement material. Would not a large floor of cement 110 feet by 1,000 feet be liable to fracture or fissuring without even any pressure applied?

Major SIBERT. It would depend on how it was put in. If you put in a layer 110 feet wide, it would be liable to crack of itself in setting,

but if you put it in in three pieces, arranged as you would the voussoirs of an arch, they would not crack; on the same principle as the building of any other arch.

Mr. STEVENS. Have you got to allow for expansion?

Major SIBERT. Practically none; the temperature is the same.

Mr. STEVENS. This floor is to be built of reinforced concrete?

Major SIBERT. No reinforcements, just concrete.

Mr. STEVENS. If there was a crack in the floor of the lock there would be erosion of the material of the soft sandstone, which might cause leakage.

Major SIBERT. Only on condition of its being connected with a fissure.

Mr. STEVENS. I will not ask you anything about the walls of the locks.

Major SIBERT. I want to say it is thoroughly feasible to build a lock that can stand all the possible pressure that can come against it.

Mr. STEVENS. Let me ask you your opinion as an engineer of experience; do you believe that dams and locks, as constructed under your plans, will be a safe structure to meet all conditions?

Major SIBERT. If the floors of the locks are so built as to stand any possible upward pressure, I consider it feasible to build a lock that will stand any strain that is brought against it.

Mr. STEVENS. Now, there are two saddles in the surrounding hills. Have you made any examination of these?

Major SIBERT. Only from borings that have been made. Some of these hills are not close. One saddle is quite close, but not the one on the Trinidad.

Mr. STEVENS. What is the height of that saddle above the lake level?

Major SIBERT. For a considerable distance it is only a few feet.

Mr. STEVENS. That would be soft earth, would it not?

Major SIBERT. Earth and underlying material. It would be necessary to increase the height of that saddle.

Mr. STEVENS. Has there been any boring in these saddles?

Major SIBERT. An attempt was made in the beginning to make a spillway there instead of through the dam, but the underlying rock bottom was not of sufficient hardness to justify this.

Mr. STEVENS. But the material was safe enough in your judgment to prevent any seepage in that direction?

Major SIBERT. Well, I do not know very much about that. I did not make any experiments in that direction.

The CHAIRMAN. Has any other gentleman any questions to ask?

Mr. HUBBARD. I understand you to say, Major, that it is perfectly feasible to build this structure so that it will be safe, and that the floors can be constructed so as to prevent the upward pressure of water through the lock floors?

Major SIBERT. That is my opinion. Major Harding thinks that by building a curtain wall you will cut off the flow, but I differ with him there.

Mr. HUBBARD. You see no value in the curtain wall, then; you do not think it will cut off the flow?

Major SIBERT. Well, I think it will not cut off the flow entirely.

Mr. HUBBARD. Your statement was that the safety of the structure was conditioned on the floor being so constructed as to prevent water flowing through the floors?

Major SIBERT. It can be so constructed.

Mr. HUBBARD. You are building an earth dam there, I understand. So far as the dam is concerned, you do not expect, and perhaps do not want, a rock foundation except as to the spillway?

Major SIBERT. I would like to have a rock foundation wherever I can get it.

Mr. HUBBARD. Did you expect it for the dam?

Major SIBERT. No, sir.

Mr. HUBBARD. Your dam will be constructed, then, by placing earth on earth?

Major SIBERT. Yes, sir.

Mr. HUBBARD. Did you resort to any additional method of promoting a union between the earth originally there and that placed on?

Major SIBERT. Yes, sir; we drive a line of sheet piling connecting the more impermeable material under the dam with the earth we place on the dirt.

Mr. HUBBARD. Is that same sheet piling driven in order to prevent or hinder the flow of water?

Major SIBERT. Yes, sir.

Mr. HUBBARD. Is there any core proposed to this dam, or is any such necessary?

Major SIBERT. It is proposed to make, as is ordinarily made in hydraulic-filled dams, a more impermeable part, which we can call a core; that is to be directly over the line of sheet piling.

Mr. HUBBARD. And so regulating the inflow that the finer particles will be deposited in that place?

Major SIBERT. Yes, sir.

Mr. HUBBARD. What is to be the width or thickness of the dam, exclusive of the toes?

Major SIBERT. One thousand two hundred feet, excluding the toe; the impermeable part will be about 1,200 feet.

Mr. HUBBARD. In addition to that, the toes on either side which are built for support and which are not for the purpose of making it impermeable?

Major SIBERT. Yes, sir.

Mr. RICHARDSON. You say you would rather have a rock foundation?

Major SIBERT. Yes, sir.

Mr. RICHARDSON. Because that more certainly can balance—can bear the great weight, can carry any load that comes on it. It is your opinion that it will resist all pressure and that it is absolutely safe, which is based on the fact that you believe that you have got at Gatun dam a safe foundation?

Major SIBERT. We have not a rock foundation there under the dam, but under the locks we have.

Mr. RICHARDSON. Is it not a fact that on the safety of the foundation of the dam the whole canal depends?

Major SIBERT. Yes, sir.

Mr. HUBBARD. Judge, allow me to ask if you are distinguishing between the lock or dam, and if you are speaking of the Gatun dam?

Mr. RICHARDSON. Yes; I am speaking of the dam.

Major SIBERT. The success of the dam depends upon having a good foundation. If you can not build the Gatun dam, you can not carry out the present project.

Mr. RICHARDSON. And it was always known there was no rock foundation?

Major SIBERT. It was always known.

Mr. RICHARDSON. And is it not true that all the precautions you can take in putting in material to resist the pressure of the water, that if the foundation is not good, all that counts for nothing?

Major SIBERT. If the foundation will not bear the load, we can not build and maintain the dam.

Mr. KNOWLAND. But in your opinion, Major, you think it can?

Major SIBERT. I think the dam can be built.

Mr. KNOWLAND. And will hold?

Major SIBERT. I think so.

The CHAIRMAN. You say that a safe and adequate floor to your locks may be had?

Major SIBERT. Yes, sir.

The CHAIRMAN. You say a secure and efficient lock may be had?

Major SIBERT. If you can prevent the breaking up of the lock floor.

The CHAIRMAN. Why do you make this condition, when you say as an engineer that you can have a safe floor to your lock?

Major SIBERT. In the investigations to determine the character of the material under this lock we dug a test pit near the lock site, going down through the same material that is encountered in the foundations of this lock. We came down to this soft sandstone of a blue variety, and we placed on that a test load of 500 pounds to the square inch, and that load finally—the whole thing—turned over, and an investigation of it afterwards showed that the particles of sand in that stone were carried out by erosion caused by ground water coming up and escaping at the edges. If we give any outlet to this water, this same thing is liable to occur by the water passing through these crevices in addition to the ground water which did take this sandstone away. If the water has no outlet, it must go on, as it always has done for centuries, through the small crevices in this rock to the sea, and the further it goes the less power it has to do damage, as it loses head by friction, and it can scour nothing if it can go on its old road to the sea.

The CHAIRMAN. I think I will ask you one question more. You have said it is practicable for you to have a safe and sufficient floor for these locks?

Major SIBERT. Yes, sir.

The CHAIRMAN. Then you further say that it is entirely practicable to have a safe lock if the floor does not break up. Now, then, if you can have a safe floor why do you put that condition of the breaking up of the floor of the lock. You are an engineer; you are charged with the sufficiency of this?

Major SIBERT. I put that condition in because if the floor is built so as to withstand the pressure that comes against it, it will not break up.

The CHAIRMAN. Can it be done?

Major SIBERT. Yes; it can be done.

The CHAIRMAN. Then, why do you put in that condition as to the insufficiency of the lock?

Major SIBERT. Well, one plan, the plan of relying entirely upon the curtain walls, is not such a plan as I think will make the lock absolutely safe. If you put in there a floor that will stand all pressure

that can be brought against it, in my opinion, the locks will be absolutely safe. The floor can be put in, and the locks made absolutely safe.

The CHAIRMAN. Then why can not you, with these premises you have suggested, say as an engineer that you can build there a safe and absolutely adequate lock?

Major SIBERT. I do say so.

Mr. HUBBARD. To put it in definite order; he first said it would be safe if the floor can be made safe, and he said secondly that the floor can be made safe.

Major SIBERT. I want to say as an engineer that I feel a safe and reliable structure can be built there at Gatun locks—safe and reliable under any and every circumstance.

Mr. CUSHMAN. In other words, in regard to this curtain wall, if you are dependent on this curtain wall fulfilling its function, you would not feel like making the floor of the locks so thick?

Major SIBERT. If I felt sure that the curtain wall absolutely and certainly cut off all access of water, I would say "build a thin floor," but I do not feel that.

Mr. CUSHMAN. And it is the doubt that remains in your mind as to how much water you may have there in spite of the curtain wall that makes you emphasize the necessity of a very heavy floor?

Major SIBERT. Yes, sir. This country is fissured, I do not know to what depth, and you do not know that that curtain wall is down below all the fissures, and is cutting out all access to the fissures.

The CHAIRMAN. There are no limitations placed on you as to the thickness of the floor, and then there is no reason in the world why we can not build it. You have charge of it, have you not?

Major SIBERT. Yes; but I do not determine the plans.

Mr. STEVENS. Major, you can calculate with fair engineering certainly the maximum pressure of that lock floor?

Major SIBERT. Yes, sir.

Mr. STEVENS. You can also calculate the amount of resistance of the material that you will use for the lock floor, and the pressure it will stand?

Major SIBERT. Yes, sir.

Mr. STEVENS. So, it is only a matter of calculation of the maximum pressure and meeting it with sufficient resistance to solve the proposition?

Major SIBERT. Yes, sir. It is as subject to exact calculation and solution as any other engineering problem. It depends on the assumptions.

Mr. STEVENS. Then there is no mystery about it?

Major SIBERT. None whatever.

Mr. STEVENS. If any pressure be exerted, it will come through the fissures in the material, which will be increased by the 85-foot head?

Major SIBERT. That is what I think about it.

Mr. STEVENS. And it is a matter of calculation how that increased pressure can be met by increased resistance of the material used?

Major SIBERT. You can make the hardest assumptions as to conditions that we can have, and the floor can be constructed so as to stand under the most adverse assumptions.

Mr. STEVENS. So it is only a question of you gentlemen working it out?

Major SIBERT. Just so, but this plan has not been determined yet.

Mr. STEVENS. So if we—Congress—give you gentlemen the money to work with, the lock can be built in such manner that it will stay?

Major SIBERT. There can be built a lock that will stay there.

Mr. STEVENS. What doubt is there about the dam itself? Where is its weakest point?

Major SIBERT. The only weak point in the dam is its foundation.

Mr. STEVENS. Over the whole length of it?

Major SIBERT. No; not over all of it. Over that part of it where this blue clay, this slippery clay, comes closest to the surface.

Mr. STEVENS. How great an area, or length, does that cover?

Major SIBERT. I could not answer that without going over the profiles, but there are 300 or 400 feet west of the French canal, between there and Spillway Hill, where this material comes fairly close to the surface.

Mr. STEVENS. You would assume that about 300 or 400 feet would be contained in the foundation of such material as you have indicated?

Major SIBERT. That amount is in the eastern gorge. For the west diversion, which is a narrow gorge, we have not as complete data as about the other, but from such experience as we have had I rather think that the nature of the material near the surface in that gorge is rather soft.

Mr. STEVENS. Now, as to the rest of the dam, outside of portions of the river, what doubt have you as to the safety of that part of the structure?

Major SIBERT. As I stated before, I think we can build a dam there on all the foundation.

Mr. STEVENS. Let us analyze the matter. Outside of this soft part, what reason is there to doubt its safety? What factor is there which would cause it to be unsafe outside of the soft part?

Major SIBERT. None, except the ability of this material to stand the load, and it is so far down as to be out of the question.

Mr. STEVENS. Then you would not question that part of it?

Major SIBERT. No, sir.

Mr. STEVENS. As to the treacherous part, what are you doing to overcome the difficulty?

Major SIBERT. We are so balancing, so arranging, the material north and south of the dam as to prevent any displacement of this material that we are now speaking of.

Mr. STEVENS. Is that a matter of calculation or experience?

Major SIBERT. Largely a matter of experience. We get on the Isthmus a great deal of experience in that line in connection with the dumps, and especially with the fills of the Panama Railroad, and it is in these two lines that our experience here lies.

Mr. STEVENS. Now, if your experience shows that a mistake has been made, and the balance can not be created at the time you expect, what happens?

Major SIBERT. During construction, if it happens, we continue to put more material in, and add more load above and below the dam, and continue building until we have a structure that will stand.

Mr. STEVENS. You just continue?

Major SIBERT. Just continue; that will be done before the lake is formed.

Mr. STEVENS. What tests are you making to continue your experience in the line of balancing as to this treacherous or deficient portion?

Major SIBERT. We will make no tests, except actual test of building. That is the only way we can load it, as it goes up. If there are slips, and there may be slips, we will meet them as we go along.

Mr. STEVENS. Then, you expect more slips?

Major SIBERT. Yes; I expect more slips.

Mr. STEVENS. Constantly?

Major SIBERT. I expect slips.

Mr. STEVENS. Do you consider it as a part of the dangers to that treacherous portion that there may be underground seepage?

Major SIBERT. I do not; that is, no deep seepages. I am rather of the opinion that that part which is soft is made soft by water seeping from the hill.

Mr. STEVENS. And that would be the utmost damage that would be caused by seepage?

Major SIBERT. I can imagine no damage to this dam caused in any other way than by slips. I believe the dam to be water-tight, and if water-tight no current can get through it. Settlement and erosion are the only two things, barring earthquakes, and if it is impermeable, as I think it is, bottom and top, I believe we can get no current of water in it that will destroy its foundations.

Mr. STEVENS. So that the real danger is in the unequal distribution of loads over the treacherous portion, causing slips?

Major SIBERT. That is the only thing that I know of, and that ought to be met in the building.

Mr. STEVENS. Now, supposing it is not met in the building. You are only human, and supposing you make mistakes, is there any material that is reserved, is there any known skill of engineering that will correct such a mistake as was corrected in the slip of the Wachusett Dam?

Major SIBERT. That slip was in the dam itself.

Mr. STEVENS. Will not this be in the dam itself?

Major SIBERT. No; this slip will be in the displacement of the material under the dam.

Mr. STEVENS. The dam would slip down in its place?

Major SIBERT. It would settle down. In the slip at the Wachusett Dam the face of it slipped off. That could not happen in our design. We have flattened the slope and put a buttress wall in so high that the material we have will not slide on itself in the face. We have gone beyond the ordinary limits considerably.

Mr. STEVENS. Then, we are getting down to the crux of the danger of the whole proposition, viz, that some of the underlying material in the gorge, the treacherous portion of it, may slip through various reasons. If that should happen, what would be the result as to the portion of the dam immediately over that slip?

Major SIBERT. If the material under the dam were displaced—enough of it—to let the dam down so that water could run over the top of it, it would all go out.

Mr. STEVENS. What precautions are you adopting to meet that possible contingency?

Major SIBERT. You can not adopt any.

Mr. STEVENS. Is it feasible to have a reserve supply of material, or to use any walls, or anything like that, that could be utilized to meet such a contingency?

Major SIBERT. The higher you build the dam, of course, the more reserve material you have on top of it, but the higher you build it, the heavier you load the foundations.

Mr. STEVENS. In order to make a slip that would be dangerous, there would have to be enough slip to let through a large volume of water or it could be repaired.

Major SIBERT. If it ever let any water through at all, it would go; that is, at the top. If it settled so that a little stream as big as your finger started over the top of the dam, it would go.

Mr. STEVENS. So you have to have a dam large enough to meet any question of subsidence for some years to come?

Major SIBERT. It would be better to so build it as to absolutely remove all risks of subsidence. If it starts after the dam is built, it is difficult to say how far it will go. It is best to meet it in the beginning.

Mr. STEVENS. In what way are you meeting it?

Major SIBERT. We are meeting it by so placing the loads above and below the dam as will prevent subsidence, and will prevent any movement of material from under the dam.

Mr. RICHARDSON. When you speak of so balancing the material, what do you mean? You have a dam so wide and so high, constructed by the pumping of certain material. What do you mean by so balancing this material?

Major SIBERT. The heaviest load on the foundation will be under the highest part of the dam. If the material on which the dam rests is not confined it must buckle up somewhere, if overloaded. If it can not move, the dam can not settle. We are adopting the plan of extending the fills above and below the dam, so as to weight down the ground to such an extent as to confine the material under the dam in case it should be overloaded. If the underlying material can not move the dam can not settle.

Mr. RICHARDSON. This balancing method consists of making the bottom of the dam exceedingly wide?

Major SIBERT. Yes.

Mr. RICHARDSON. Then the balancing you speak of takes place when you make the plans for the great width of the dam, and not when you dump the material?

Major SIBERT. The dumping of the material is simply carrying out the plan. The plan is to carry the toes so far as we have material to carry them, and so extend them as to balance the pressure of the dam.

Mr. STEVENS. Where is your deficiency of material?

Major SIBERT. I think we have enough.

Mr. STEVENS. What material do you want?

Major SIBERT. Any material. We are using the material from the canal prism.

Mr. STEVENS. Is it impervious?

Major SIBERT. It is not impervious; it is mostly rock.

Mr. STEVENS. What is that stuff you are pumping out of the river?

Major SIBERT. Material out of which to build the superstructure of the dam.

Mr. STEVENS. What is it that weights down the foundation?

Major SIBERT. The waste material from the lock excavation, and at Mindi, and at Bohio, and anywhere in the canal.

Mr. STEVENS. And you have sufficient of that?

Major SIBERT. Yes, sir.

Mr. STEVENS. If you concede that it will be necessary to farther extend the dam to assist in the process of balancing your weighting, or preventing disturbance, you have the material to do it with?

Major SIBERT. Yes, sir.

Mr. STEVENS. I noticed a criticism in the Washington Post along the same line; that the inherent defect is the geological structure of the Isthmus; that the foundations are so unstable that no engineering skill can overcome that inherent defect; that fissures will come through unknown material. Don't you know about the material in these gorges?

Major SIBERT. Yes, sir. As much as man can know it. We have put test holes all through it; we have put a test pit to 70 or 80 feet below sea level on Gatun Island, and have actually examined the material as it exists in situ down to that depth.

Mr. STEVENS. If you have made your test pits, and if you have made your calculations as to the strata connecting them, what does your experience show as to the actual kind of material when you come to excavate? Does the excavation sustain your calculations?

Major SIBERT. We make no calculations as to the material under the dam, but the excavations show a material that is practically impermeable, underlying what we might call the soil stratum on the top. There is no chance in my mind of any volume of water passing through this underlying material so as to scour it. In fact, it is better than most of the material we come in contact with, so far as impermeability is concerned.

Mr. STEVENS. So that that criticism that is made, that you do not know of the material that you are dealing with in these gorges, is unfounded?

Major SIBERT. We know it as well as any man can know it.

Mr. STEVENS. And you are making your calculations on the knowledge found in that way?

Major SIBERT. We are making our plans on that knowledge, and we base the assertion that there will be no seepage on the character of the material in this test pit.

Mr. STEVENS. Is there any limitation by experience of the slipping of these materials; that is to say, there are certain materials you find in these gorges, you find them confined by walls that are immovable, you find them under conditions that you know fairly well. Is there any calculation that you can make that will show the amount of resistance of these treacherous materials in slipping one way or another?

Major SIBERT. Yes, sir. There are ways by which the frictional resistance to slipping can be determined, and we have had tests made of that. The only thing we can go by, and the most reliable thing, is what it actually does when we come to build.

Mr. STEVENS. And that you are working out along these lines—of meeting these objections that you know?

Major SIBERT. Yes.

Mr. STEVENS. And that are urged here?

Major SIBERT. That objection is one of seepage and one of finding fissures. There are no fissures in these gorges. The material is not rock and is very close and compact.

Mr. STEVENS. So that there is nothing in this objection to indicate that the flow of water is such by seepage that it would prevent a lake being formed?

Major SIBERT. Through the material in the Gatun Valley?

Mr. STEVENS. Yes.

Major SIBERT. I do not think there will be any material amount of flow through this material.

Mr. STEVENS. Now, this engineer, a one-time member of the commission, is alleged to have said that the water-bearing material under the Chagres River is such that it makes flow against the current of the river almost equal to the flow of the river itself. Do you know anything about that?

Major SIBERT. No, sir. It is an impossibility.

Mr. STEVENS. He says that there is a flow upstream; that the material under the river bears water to such an extent that it prevents the Chagres River enlarging its current much coming down the river.

Major SIBERT. That is impossible. Water can not flow unless it has a head to make it flow.

The CHAIRMAN. Where does it go to?

Mr. STEVENS. It does not say. Then you think the criticism made by Professor Burr, in the New York Herald of December 14, that the seepage is a difficult matter to restrain in this kind of dam is unfounded?

Major SIBERT. He means seepage?

Mr. STEVENS. He says seepage.

Major SIBERT. Well, I think the question of seepage in a dam made of earth is susceptible of almost accurate determination by means of building experimental dams.

Mr. STEVENS. That is, the seepage through the dam you build, but how about the material under the dam?

Major SIBERT. You can take that material and subject it to seepage tests, as has been done in this case, and I feel satisfied that there will be no material seepage through the Gatun dam proper or the material underlying the dam.

Mr. STEVENS. The real danger is the one we have pointed out?

Major SIBERT. I would not say the real danger, I would say the only chance of danger.

Mr. STEVENS. And you are meeting that?

Major SIBERT. Yes; in the manner described.

The CHAIRMAN. You say a lock can be built there, a lock that will stay, and you put emphasis on the word "can." I want to know if, in your judgment, such a lock can be built under the present adopted scheme or plan?

Major SIBERT. Under the general plan; yes, sir.

The CHAIRMAN. Under the plan now adopted to build three locks at Gatun?

Major SIBERT. Yes, sir.

The CHAIRMAN. Then, you have no doubt at all in your mind, as an engineer, about the general practicability of this enterprise under the scheme and plan as it has been from time to time evolved and expressed.

Major SIBERT. I feel that the locks and dams can be built. There is some chance of danger in the Gatun dam foundation, but I do not think it is material enough to constitute an obstacle. It is in the range of possibility that some slips might happen, but whether it is in the range of probability or not, I do not think it is. That is, the slipping of the underlying material of the Gatun dam. That, to my mind, is the only weak point in the scheme, if there is a weak point. As to the water supply of the lake; the question of seepage loss, not under the Gatun dam, but through the hills around it, that is a question we can only guess at.

The CHAIRMAN. Has there been no such exploration made as will enable you to say that after your work has been accomplished, and you have got your 85 feet of head, that all that may not be destroyed by the escape of these impounded waters by fissures you do not know anything about?

Major SIBERT. We know it will not escape over any low places in the surrounding hills, but we do not know with any great degree of definiteness the character of the rock and of the material constituting the rim of the lake.

The CHAIRMAN. You have spoken a little while ago of one portion of the rim of the lake that was 2 feet above the lake level. What is the width of that rim?

Major SIBERT. It is of considerable width at that place.

The CHAIRMAN. In feet or miles?

Major SIBERT. In feet, not in miles. We purpose to reenforce these low places by a dam, or levee, built on top of the ridge.

The CHAIRMAN. Is there any disaccordance of opinion on the part of the engineers now engaged in this work as to the feasibility of the plans?

Major SIBERT. Not that I know of.

The CHAIRMAN. Is there general harmony among the engineers as to its feasibility?

Major SIBERT. As to the feasibility of the general plan, that it can be carried out, yes, sir.

The CHAIRMAN. Within the limits of reasonable cost?

Major SIBERT. Yes; there is no reason to suppose that there will be a greater cost unless something unforeseen happens.

Mr. RICHARDSON. Following up the question I first asked you on the subject of the foundation, I would like to put to you this question: As an engineer, do you believe that if by nature such a defect as this at the Gatun dam that fails to provide a safe foundation for the weight such as is proposed, that engineering skill and ability can overcome that defect and provide a safe foundation for that dam?

Major SIBERT. Let me see that question please. I should think it would be possible to overcome it by removing all of the soft material referred to, and which, if anything, did constitute a defect that nature has placed there, I think it will be physically possible to remove any soft material about which suspicion may exist.

Mr. HUBBARD. Major, going back to the question, I ask whether, when you came on this work, you had any part in the selection of the present plan or were prejudiced in favor of it; or if you have been concerned in that part of the work?

Major SIBERT. None whatever.

Mr. HUBBARD. There may be a suspicion that, owing to your position in the United States Army, you might not have felt free to make any objections to the feasibility of this plan, if such a thing had occurred to you. I wish to ask if you would, or would not, have felt free to make known any such objection?

Major SIBERT. I would feel free to make it known if the defect was vital.

Mr. HUBBARD. That is, if you were set to execute a piece of work according to somebody else's plan, and had come to the conclusion that it could not be carried out, there would be a way to make it known with propriety to some one?

Major SIBERT. I would not build a thing I did not think would stay there, unless I had notified some one in higher authority than myself of my fears, and this higher authority assumed responsibility for the plan.

Mr. HUBBARD. Have you ever felt such a desire to make a report?

Major SIBERT. I have always had confidence in the Gatun dam, and these difficulties, which are not serious, which we are encountering now are the only things that have happened to throw any discredit on the scheme, and that is entirely in the foundation. I have not had sufficient data to form any definite conclusion as to loss of water by seepage in this lake, and that is a question I have no thorough way of investigating; it is a chance we have to take on the proposition.

Mr. STEVENS. I do not know if it is serious or not; it would be if you could not hold the lake.

Major SIBERT. It is an unknown field to me.

The CHAIRMAN. In the dry season there is always an inflow into the lake?

Major SIBERT. Yes; but not sufficient for canal purposes. During the dry season there will be a continual loss from evaporation, and we have to impound in this lake all the reserve flow of water from the Chagres River for the dry season.

The CHAIRMAN. That is practicable?

Major SIBERT. Yes; we can impound all the flow of the Chagres River. We do not do it in the present plan, but if we had three more feet of storage we would impound all of the water in the driest years. That would not be a very expensive proposition.

Mr. HUBBARD. At what depth does this soft, slippery material exist?

Major SIBERT. It is not all soft; it is only soft in places.

Mr. HUBBARD. At places where it is so soft as to raise this question in your mind?

Major SIBERT. It is fairly close to the surface.

Mr. HUBBARD. Can you express it approximately in feet?

Major SIBERT. Some of it practically comes to the surface.

Mr. HUBBARD. What is the depth of it from the top down?

Major SIBERT. In one place it seems to change into a stiffer clay at 87 feet below sea level. There is a soft bluish clay down to 76 feet below sea level. In some places it is deeper and in some places not so deep. That clay material is not all soft; the material in the French canal was not very soft; that was a harder variety.

Mr. HUBBARD. It is found both under the toes of the dam and under the 1,200 feet of width of the impermeable part?

Major SIBERT. We have developed two soft places practically in the toes of the dam. In the west diversion we have only developed it in the toe of the dam.

Mr. HUBBARD. You mean that you do not know whether it exists under the impermeable part of the dam?

Major SIBERT. I do not think it exists there in as soft a condition as it does in the toes of the dam.

Mr. HUBBARD. Have you any reason to suppose that it exists to a serious extent under the impermeable part of the dam?

Major SIBERT. I have reason to think it is not so soft. There are swampy places at the toes. Evidently the water comes out from the hills and makes the ground softer there.

Mr. HUBBARD. You intend to prevent the slip?

Major SIBERT. Yes; we will drive this material out by the load in the toes.

Mr. HUBBARD. After your construction is completed and the water in the lake site comes in, will there be any danger of that ground coming up under the weight of that water?

Major SIBERT. I think that the pressure of the water in the lake will help conditions.

Mr. HUBBARD. Whatever danger there may be in this would be more apt to manifest itself during construction than afterwards?

Major SIBERT. That is my judgment.

Mr. HUBBARD. If such a thing could be as that this concrete floor 9 or 11 feet thick is insufficient—if it turned out that that would not prevent the uprising of the water through the floor—how soon would it become manifest?

Major SIBERT. The first time we pumped out the lock. But there is no question about that phase of it. You can so build the floor as to stand any possible pressure.

Mr. HUBBARD. And you can ascertain that scientifically?

Major SIBERT. Yes; you can make the hardest assumption that can exist and design against it.

Mr. HUBBARD. And in your judgment it is designed against by 11 feet of thickness?

Major SIBERT. I think if you put an inverted arch in the floor that thick at the crown, it will stand any pressure that will come against it and prevent any escape of water.

(The committee thereupon took a recess until 1.30 o'clock p. m.)

AFTER RECESS.

STATEMENT OF LIEUT. COL. H. F. HODGES, U. S. ARMY.

Mr. STEVENS. What is your name and station on the Isthmus?

Colonel HODGES. H. F. Hodges; member of the commission and assistant chief engineer.

Mr. STEVENS. What is the particular nature of your official work?

Colonel HODGES. I am charged with the design of the locks, dams, and regulating works.

Mr. STEVENS. What has been the nature of your professional experience in this line of work?

Colonel HODGES. My first duty in this general line was from 1885 to 1888, when I was assistant to General Poe. At that time the Weitzel lock at Sault Ste. Marie had been completed and plans for the Poe lock were being prepared, and I had a hand in the preparation of those plans. Subsequently, after four years as instructor and

assistant professor of engineering at West Point, I was assistant to Colonel Stickney on river work—work of this same nature, somewhat; that is, locks and dams. From 1893 to 1896 I had charge of a district on the upper Missouri River. From 1896 to 1898 I was a member of the board which had charge of making the typical plans for emplacements for seacoast defense. In 1898–99 I was in the field with a volunteer regiment. From 1899 to 1901 I had charge of a district on the tributaries of the Ohio River, including the Kentucky, Big Sandy, and Muskingum rivers, which are slack-watered streams, on which I had 4 locks and dams to design or build and about 30 to operate. From 1901 to 1902 I was chief engineer of the Department of Cuba, under General Wood. From 1902 to 1907 I had charge of the river and harbor division in the office of the Chief of Engineers, which made me, to a certain extent, a consulting engineer on works of this character. Since then I have been with the Isthmian Canal Commission in one capacity or another.

Mr. STEVENS. When did you come upon the Isthmus to assume your position?

Colonel HODGES. Early in July of last year.

Mr. STEVENS. In your professional experience have you written professional papers upon subjects of this nature?

Colonel HODGES. Yes; I wrote a paper on the construction of lock gates.

Mr. STEVENS. So that you are familiar with the literature of this subject in the profession?

Colonel HODGES. In a general way, yes.

Mr. STEVENS. Have you personally acquainted yourself with the plans and with the situation on the ground?

Colonel HODGES. I have.

Mr. STEVENS. Of the Gatun project?

Colonel HODGES. I have.

Mr. STEVENS. Please give us the benefit of your knowledge and experience and judgment as to the safety and reasons for safety, first, of the locks and lock foundations.

Colonel HODGES. First, as to the safety of the locks themselves: The walls are calculated to stand any pressure which we can find it possible for them to be brought under, with an ample margin of safety; that is to say, the land walls may be exposed to a thrust from the filling in rear. This would be counterbalanced in ordinary operation by a thrust from the water in front. Those walls, however, are calculated to withstand the thrust from the back when the locks are unwatered, as they will be on rather rare occasions, for purposes of examination. The greatest strain that is brought in the masonry under those circumstances, and that only in a very small part of the masonry, is 18 tons to the square foot, which is very much less than the concrete will stand; that is, in the body of the masonry. Where the masonry rests on the rock, at what might be termed the bed of the foundation, it is so spread that the pressure on the rock will be considerably reduced. I heard it stated by another witness that this pressure would be about 250 pounds per square inch. It will be less than that, and will not exceed 200 pounds per square inch.

Mr. STEVENS. In what way do you distribute that pressure so that you can depend upon its being distributed?

Colonel HODGES. The greatest strain falls on the masonry between the gate recesses of the middle wall, where cavities are provided in the wall so that the front of the gates will be flush with the face of the wall after they are opened. These cavities thin the walls at that point by double the thickness of the gates, so that instead of 60 feet thickness there will be only 43 feet where the gates swing and the greatest stress is found. This thin wall, however, does not extend entirely to the bottom. On the contrary, there will be, according to the character of the rock we find, from 6 to 13 feet of masonry below the bottom of the gate recesses, of the full thickness of the wall and spreading out into the masonry of the floor, so that the actual foundation of the wall is spread at the base and the pressure consequently reduced. So much for the wall.

You asked about the foundation. The character of the foundation was fully explained to you this morning by those who are thoroughly familiar with it. In my opinion, with proper precaution to remove the softer sandstone as it is exposed there is no question that the remainder of the foundation and the concrete with which we shall plug the holes where the soft stone is removed will have strength greatly in excess of any pressure which can be brought to bear on them.

Mr. STEVENS. What, in your estimation, is the danger of pressure of the water upon the lock floor by reason of the water in the lake coming through a fissure in the rock—a seam somewhere—and finding an exit through a weak place in the lock floor?

Colonel HODGES. I do not consider that to be a danger which can not be readily provided against.

Mr. STEVENS. You have that in mind in the preparation of the plans for these locks?

Colonel HODGES. I have.

Mr. STEVENS. So that as far as human ingenuity can provide—and you say it can—that may be considered as eliminated?

Colonel HODGES. Yes.

Mr. STEVENS. Now as to the dam itself. What is the weakest place in the structure of the dam as it will be finally placed on the face of the earth?

Colonel HODGES. In the structure of the dam I know of no weak place.

Mr. STEVENS. That is to say, so far as the dam itself goes, that is impervious and complete and may be eliminated?

Colonel HODGES. I thoroughly believe so.

Mr. STEVENS. Now, in the foundation of the dam, what is the weakest place or possibility of trouble?

Colonel HODGES. A movement of the substance of the dam due to a sliding on the slippery layer of its foundation.

Mr. STEVENS. What will be the cause of that?

Colonel HODGES. Unbalanced pressure overhead.

Mr. STEVENS. Any other cause?

Colonel HODGES. The slippery nature of the foundation.

Mr. STEVENS. Yes; but would seepage cause that?

Colonel HODGES. I do not anticipate any danger from seepage.

Mr. STEVENS. So that would be the sole possibility of weakness or danger—the slipping, as you have stated it?

Colonel HODGES. Yes, in my opinion.

Mr. STEVENS. In what way are you guarding against that?

Colonel HODGES. Both in the plan of the dam and in the manner in which the material of the dam will be placed. It is part of the plan to confine the impervious portion of the dam, 1,200 feet thick, between piles of stone forming the toes of the slopes, outside of which piles of stone are further blankets of earth, ranging in height from that of the stone piles to a convenient height at the point farthest outside the slope. Those blankets of earth outside of the toes are planned to be so wide that they will hold down the crust of earth overlying the soft layer for a very considerable distance outside of the toe and prevent any heaving up of that crust for such a distance that the friction of the underlying material—slippery material—on the under surface of the crust, and on the upper surface of the more solid layer underneath, will become such that it can not be squeezed out. Then inside the toes the main mass, or the impermeable portion of the dam, rises with slopes so gradual that there is no sudden load thrown on any part of the bed underneath, and the pressure on that, while it increases gradually toward the middle of the dam, does not change suddenly anywhere. While the portion under the crown of the dam is most heavily loaded, yet that heavy load will not be sufficient to overcome the friction induced by the blanket on the outside of the toes and to squeeze the soft material out from under the dam.

Mr. STEVENS. What would be the effect of water pressure on the inside?

Colonel HODGES. Water pressure on the inside, in my opinion, would add stability by pressing down outside of the dam and aiding in preventing an upward movement of the crust. In depositing the dam as above proposed by the hydraulic process, the weight comes gradually on the foundation; there is no sudden load thrown on it, as was thrown on it when this toe was built and the balancing weight on the inside removed by pumping out the water. The successive layers of material rise almost imperceptibly as the water-borne material settles, and no sudden load can therefore come on any portion of the foundation with proper precaution.

Mr. STEVENS. Now, under those circumstances, do you anticipate that if there be any defect in the project, or any conception, as you have planned it, that it will appear during the process of construction, or would it appear after the completion of it?

Colonel HODGES. I should say that, having built the dam and got it to stand in the dry, it will be safer after the lake is against it; that is, the defect would appear during construction rather than afterwards.

Mr. STEVENS. Now, if some defect should exist of which you do not know, and a slide should occur and the dam would subside and fill in a cavity, what would happen?

Colonel HODGES. It would have to be a cavity of very considerable size to bring the crest of the dam down so that the water would get over it. The slump would probably be a local one, which would have to be mended afterwards, and would be susceptible of being mended. Of course if the slump was so complete and universal as to make the whole section of the dam subside sufficiently to bring the crest below the water level, the water would flow over. We might even then succeed in mending it.

Mr. STEVENS. Are you acquainted with the material in the gorges at the places where the greatest weakness occurs?

Colonel HODGES. I have seen the borings, and I have seen material brought up from test pits.

Mr. STEVENS. And you know the reasonable probabilities, from your experience, of any slides that might occur in such material?

Colonel HODGES. Yes, sir.

Mr. STEVENS. And you are preparing to guard against such things as, from your experience, has shown exist in that sort of material?

Colonel HODGES. Yes; I confess that I expect slides in the construction of the dam, to a certain extent. I think it would be beyond human probability that we shall not have them, but my present view is that they will be local affairs, and can be dealt with when they come.

Mr. STEVENS. So you feel you could guard against any reasonably large subsidence even after the dam was completed and water let into the lake?

Colonel HODGES. I believe that a very reasonable subsidence can occur without endangering the dam. I do not think we can guard against it. I do not think we can foresee when it will take place. In my opinion, if that dam is built and made to stand before water gets against it, there is no probability of any slide taking place afterwards.

Mr. STEVENS. You have been somewhat familiar with dams of a similar nature in other places?

Colonel HODGES. Only through literature; I have never built any earth dams, except cofferdams.

Mr. STEVENS. Are you familiar with the construction of lock gates, and that sort of thing?

Colonel HODGES. Yes.

Mr. STEVENS. There has been criticism that lock gates and mechanisms could not be provided adequate to handle the water and ships of such large construction. What have you to say as to that?

Colonel HODGES. I have no doubt as to the possibility of doing it. In fact, we have done it in cases of structures and vessels of comparable size, and it has been done in other parts of the world in cases of structures and vessels of nearly the same size, especially as to the vessels.

Mr. STEVENS. But not of locks of that size?

Colonel HODGES. The locks are not so large, but the vessels are.

Mr. STEVENS. Is there any danger in the mechanism not operating with gates of that immense size?

Colonel HODGES. Of course there is danger, but it involves no disaster.

Mr. STEVENS. There has been criticism that there would be disaster in cases of vessels not perhaps following the regulations, of ships crashing through the flight of locks. What has been the history of such cases?

Colonel HODGES. Ships have struck lock gates a good many times. The large gates at Sault Ste. Marie have been struck two or three times. There has never been anything approaching a disaster there. The gates and ships have been damaged, but the water was not let out.

Mr. STEVENS. Has any ship that you know of ever gone down through a flight of locks?

Colonel HODGES. Not by crashing through the gates.

Mr. STEVENS. So that the criticism of engineers to that effect is not substantiated by experience or history of lock navigation?

Colonel HODGES. I should say not. It is a danger, but there is a present danger in everything. It must be guarded against by care.

Mr. STEVENS. Will you state how many safety devices you have put into these locks—just as a matter of record?

Colonel HODGES. At the head of each flight we have what we might call two safety devices. The one is a rolling gate above the lower mitering gates, which is intended as a buffer to guard against the lower gates being struck by a vessel entering the locks from above. The other is above the upper gates, a movable dam of the swinging bridge type, which can be put into position and will close the waterway gradually, and which is intended to be operated in case, through any disaster, the gates are cut away and a current established through the lock from the upper level to the lower.

Mr. STEVENS. So far as history and experience have given you information, the last device can be reasonably relied upon to prevent disaster?

Colonel HODGES. It is the best we know of. They have had for years at the American Sault a movable dam of the general type described, which is now temporarily out of use; they had it for years, but it was never called into play.

Mr. STEVENS. Was it brought into play at the time of the disaster three or four years ago?

Colonel HODGES. No, sir.

Mr. STEVENS. Those lock gates were opened so that the water gushed out?

Colonel HODGES. The upper gate was closed. They closed the movable dam very frequently, and operated it very frequently, but never in the face of the current. There is every reason to believe that it would work properly in the face of a current.

Mr. STEVENS. Just return to the dam construction for a moment. From your preliminary statement, you have had a great deal of experience in the construction of dams on rivers and moving currents of water?

Colonel HODGES. I have had considerable experience.

Mr. STEVENS. What is your experience in the construction of dams which completely eliminate the possibility of danger or trouble with the washing of the dam?

Colonel HODGES. I designed one that I thought eliminated it completely, and three or four years afterward it was washed around [laughter].

Mr. STEVENS. What is your experience, then, in minimizing the danger as much as possible—what would you seek to do, in other words?

Colonel HODGES. Just that; minimize the adverse chances. I do not believe there is a structure in existence in which the adverse chances have been reduced to zero.

Mr. STEVENS. That is to say, that no engineering work of any importance exists without some danger or weakness somewhere?

Colonel HODGES. I believe not.

Mr. STEVENS. And the skill of your profession depends on minimizing it and guarding against it as much as possible?

Colonel HODGES. Yes.

Mr. STEVENS. In your long and varied experience, do you deem it your official duty to point out defects which would work disaster in the project you are engaged upon, whenever they occur to you in anyway?

Colonel HODGES. Grave defects; yes.

Mr. STEVENS. Would you conceive it your duty, if you found such a condition?

Colonel HODGES. I should, if I thought anything invited disaster.

Mr. STEVENS. You would conceive that a duty of yours?

Colonel HODGES. Unquestionably.

Mr. RICHARDSON. What is the character of the foundation of the dam in the flight of locks on the Pacific side?

Colonel HODGES. They have a very good foundation—a rock foundation for the locks; and if you go down far enough below the surface you will find rock under the dam.

Mr. RICHARDSON. How far down? What is the number of feet you go down in the first dam?

Colonel HODGES. There is a lift of 30 feet.

Mr. RICHARDSON. What is the depth of water on that dam?

Colonel HODGES. About 25 feet pressure.

Mr. RICHARDSON. What is the length of that dam?

Colonel HODGES. Call it about 1,300 feet. I don't remember exactly.

Mr. RICHARDSON. Now the next dam. What is the fall there, on the Pacific slope?

Colonel HODGES. Sixty feet, allowing for mean tide.

Mr. RICHARDSON. What is the depth?

Colonel HODGES. It would be about that.

Mr. RICHARDSON. What is the character of the foundation?

Colonel HODGES. The dam itself rests on the surface of the earth, but the lock rests on the rock.

Mr. RICHARDSON. Have you, as an engineer, the same faith in the foundation of Gatun dam as you have got in the foundation of the two dams I have just asked about?

Colonel HODGES. The foundation on the Pacific coast is better than the Gatun foundation.

Mr. RICHARDSON. Why?

Colonel HODGES. It is better rock.

Mr. RICHARDSON. And you get a better foundation?

Colonel HODGES. Yes, sir.

Mr. RICHARDSON. And you have not the same faith, as an engineer in the foundation of the Gatun dam, for the reason that the Gatun dam does not rest on rock and the other two do rest on rock?

Colonel HODGES. I do not quite grasp the meaning of your statement. If you mean the foundation, it is correct; if you mean the completed structure, it is incorrect.

Mr. RICHARDSON. I mean the safety of the foundation of the Gatun dam. Have you as much faith in the safety, as an engineer, of the foundation of the Gatun dam, as you have in the safety of the two dams about which I have just asked?

Colonel HODGES. In the foundation, no; in the completed structure, yes.

Mr. RICHARDSON. Why?

Colonel HODGES. It is the natural character of the soil.

Mr. ESCH. You have built structures on the Missouri and Kentucky rivers?

Colonel HODGES. Yes.

Mr. ESCH. How would those structures compare as to the safety of the proposed structure at Gatun?

Colonel HODGES. They were very much smaller, and hardly comparable. As I said, I thought that one of them on the Kentucky was absolutely safe, but it was washed around later. We had solid rock foundation on the Kentucky River.

Mr. ESCH. Did you state the width of the footing for the lateral walls of the rock?

Colonel HODGES. I did not state; however, it is 50 feet wherever complete pressure can be brought against it.

Mr. ESCH. Now, the water face of those walls will be practically vertical?

Colonel HODGES. It will be vertical except at the very bottom.

Mr. ESCH. And the earth side will, of course, incline from 50 feet at the base?

Colonel HODGES. Yes; by steps, to 8 feet at the top.

Mr. ESCH. Now, when the lock is empty, that wall is subjected to the lateral thrust of the earth. Would that increase the pressure of the lock wall upon the natural surface below?

Colonel HODGES. Undoubtedly.

Mr. ESCH. Would that continued pressure, for years, tend to throw the wall out of plumb?

Colonel HODGES. No; not if properly constructed.

Mr. ESCH. And you have observed the known rules of construction?

Colonel HODGES. We have.

Mr. ESCH. And what is the width of the footings of the middle wall?

Colonel HODGES. Sixty feet. I will qualify that. It is 66 feet in the lock chamber where there is a widening out at the bottom.

Mr. ESCH. And what is the width at the top?

Colonel HODGES. Sixty feet, vertical sides, but all of that is not masonry. There is a space left for back filling.

Mr. ESCH. You say you do not anticipate much difficulty or danger from the upward pressure of water on the floor of the lock?

Colonel HODGES. No.

Mr. ESCH. Conceding that there was this danger of upward pressure, as testified to by Major Sibert, would there be more of that upward pressure on the floor of the first locks than on the middle locks?

Colonel HODGES. On the upper locks—unquestionably.

Mr. ESCH. And more on the middle than on the lower locks?

Colonel HODGES. I should not be certain of that point. The pressure on the middle-lock floor from the ground water might be more or less than the pressure on the lower-lock floor from the sea level.

Mr. ESCH. If this danger is as significant as Major Sibert believes it to be, might there not be pressure coming up below the end of the last or lowest dam?

Colonel HODGES. There will be pressure from the sea level coming up.

Mr. ESCH. From the lake level?

Colonel HODGES. I do not think it possible.

Mr. ESCH. Do you think 3,000 feet of the natural earth, as it now is, will be sufficient to retard, if not practically eliminate, any of that pressure?

Colonel HODGES. I feel confident of that.

Mr. ESCH. Unless there be such seams of such character and dimensions that there would be a natural channel underneath?

Colonel HODGES. If there is an underground stream there, we shall undoubtedly discover the fact in the course of construction.

Mr. ESCH. Do you believe that this cement curtain in the fore bay will be sufficient to cut off most of that underground flow?

Colonel HODGES. I think it will cut it off to a great extent, if not entirely; but I think we have a means of judging that which has not yet been touched upon. When the excavation for the curtain wall is made, it will cut off that flow as effectively, so far as the present conditions are concerned, as the wall itself, and we can observe the floor of the lock after that excavation has been made.

Mr. ESCH. Do you think that would be a demonstration?

Colonel HODGES. I think it would be a very strong indication. We shall not have an 85-foot pressure against it, but we shall be able to see if any natural channels of any magnitude exist which bring the water down from the hills.

Mr. BARTLETT. I call your attention to a statement of the daily paper in which Mr. Bates said it was impossible to construct any locks and have large ships come in without damaging the gates. Did you read that?

Colonel HODGES. Yes; I read that.

Mr. BARTLETT. Now, is it true that you have appliances and means by which that danger is reduced to a minimum?

Colonel HODGES. Yes; we have reduced it so far as we can.

Mr. BARTLETT. One of those, as I understand it, is not to permit the ships to be brought in by the person in charge of the ship himself. You place people in charge of the locks to conduct ships in themselves?

Colonel HODGES. We can do so. We shall provide means by which that can be done.

Mr. ESCH. Do they provide for a gate that operates on a track that can be run out across the axis of the lock? What do you do with that when you intend to open the lock?

Colonel HODGES. Run it back into the gate chamber.

Mr. ESCH. Where is the chamber with reference to the wall of the lock?

Colonel HODGES. It is a recess in the wall of the locks and perpendicular to it.

Mr. ESCH. How deep?

Colonel HODGES. The length of the gate that runs across the lock, probably 118 feet.

Mr. ESCH. Can that be done without any weakening?

Colonel HODGES. Oh, yes; the Ohio River locks are worked that way.

Mr. BARTLETT. These are very large gates?

Colonel HODGES. They are the largest in the world.

Mr. BARTLETT. Can you give me the weight of them?

Colonel HODGES. The largest leaves of the miter gates will weigh about 500 tons each, the miter gates being the gates that turn on hinges and close against the miter sills. That is the weight of each leaf, and there are 84 leaves on the whole canal.

Mr. CUSHMAN. When you say a leaf, do you mean a single gate?

Colonel HODGES. One of the moving parts of each gate.

Mr. CUSHMAN. Then there are two of those leaves in each gate?

Colonel HODGES. Yes.

Mr. RICHARDSON. What is the pressure of the water on the Gatun dam, 85 feet high? What is the pressure per square foot?

Colonel HODGES. Down at the bottom about 5,312 pounds to the square foot.

Mr. RICHARDSON. Is that pressure dependent upon the area the water covers?

Colonel HODGES. No; it depends purely upon the depth.

Mr. RICHARDSON. The greater area it covers does not increase the pressure?

Colonel HODGES. Not in the slightest degree. If the Gatun Lake were only an acre in extent and 85 feet deep it would exert the same unit pressure against the dam.

Mr. RICHARDSON. And the area covered from the Gatun dam is 174 square miles?

Colonel HODGES. Approximately that.

Mr. RICHARDSON. And if it was 274 square miles the pressure would not be increased?

Colonel HODGES. No.

Mr. ESCH. You feed the water of the locks from the side. What is the advantage?

Colonel HODGES. The valves can be operated more directly than if the culverts were placed along the axis of the lock.

Mr. BARTLETT. Can you give us some idea, without any unforeseen or unlooked for accident, with the means at hand, how long will it take to complete the locks and dam?

Colonel HODGES. Our estimate is January 1, 1915, which would be six years from now.

Mr. BARTLETT. Is that a reasonable estimate?

Colonel HODGES. I think it is; I see no reason to change it; I should like to have a little longer, but then—

Mr. ESCH. Will-ships be able to go through the lake under their own steam?

Colonel HODGES. Yes.

Mr. ESCH. At what speed?

Colonel HODGES. As fast as they like.

Mr. ESCH. There is no danger of washing on the dam?

Colonel HODGES. No; we can obviate any danger of that.

Mr. KENNEDY. You gave the amount of pressure per square foot of surface. As you figured that, it would be the lowest square foot, and each square foot above would have less pressure?

Colonel HODGES. Yes.

Mr. KENNEDY. Against the gates of the lock opening into the forebay—would there be much less pressure against those gates?

Colonel HODGES. They are not so deep; they would have a pressure due to their height entirely.

Mr. KENNEDY. Due to the height of water against them?

Colonel HODGES. Yes.

Mr. KENNEDY. That could not exist at any time over 30 feet?

Colonel HODGES. Oh, yes; those gates will be about 52 feet high.

Mr. KENNEDY. Then the water would be maintained behind them?

Colonel HODGES. That is quite correct, in the general operation, but we have to figure them to hold the pressure when the lock is dry.

Mr. KENNEDY. You would want it strong enough if the lock is dry. In the operation of the lock——

Colonel HODGES. In the operation it would be 30 feet for that one, and 60 feet for the gates below.

Mr. KENNEDY. And the burden for holding that pressure for the 60 feet difference would be divided up between two sets of gates?

Colonel HODGES. Not necessarily. You see the lower gates of the upper and intermediate locks may have, in ordinary operation, the full 60 feet against them, because their lock may be full when the one below is reduced to the low level to let a vessel in. You double your lift in the intermediate locks.

Mr. KENNEDY. The average pressure against a square foot of this dam would be very much less than the amount you have given?

Colonel HODGES. Very much less; I gave the maximum.

Mr. KENNEDY. You gave that square foot that would have most against it?

Colonel HODGES. Yes.

Mr. ESCH. Will this partition gate itself divide a given lock into compartments 400 feet and 600 feet long, respectively, the 400-foot section at the same end of each series of locks?

Colonel HODGES. Not always. The 400-foot section is at the upper end of the upper locks; then comes the 600-foot section. There is really no theoretical difference; you can change them around and get the same economy of water. It is a little more convenient to have the 600-foot section of the second lock contiguous and right in communication with the 600-foot section of the lock above, when practicable, but you can not do it in all cases.

Mr. STEVENS. There is no greater danger in any one of those locks than in the Soo locks, as to vessels plowing through?

Colonel HODGES. Not as much. We have more precautions than the Soo. That has no buffer gate.

Mr. STEVENS. And the ships will be heavier through this one?

Colonel HODGES. Much heavier, and harder to handle.

Mr. STEVENS. What is the beam of our newest type of battleship?

Colonel HODGES. The biggest under construction, I think, is 88 feet. Admiral Rousseau knows more about that than I do.

Mr. CUSHMAN. We saw a relief map of the dam and the lock, etc. In the construction of these locks, do you ever build anything like a model?

Colonel HODGES. Oh, yes.

Mr. CUSHMAN. Do you propose to construct a model in this connection some time in the progress of the work?

Colonel HODGES. I was going to put it up to the chief engineer some time; yes.

STATEMENT OF CIVIL ENGINEER H. H. ROUSSEAU, U. S. NAVY.

Mr. STEVENS. What is your name and present official position in connection with the commission?

Mr. ROUSSEAU. H. H. Rousseau; I am a member of the Canal Commission, and also assistant to the chief engineer.

Mr. STEVENS. What has been your professional and official experience along the line of these duties?

Mr. ROUSSEAU. I was graduated at the Rensselaer Polytechnic Institute, Troy, N. Y., in 1891, with the degree of civil engineer. After that I practiced civil engineering for seven years in various kinds of engineering construction, particularly steel construction, and was engaged on the design and manufacture of steel structures as principal assistant engineer of the Pittsburgh Bridge Company for several years. In 1898 I was commissioned a civil engineer in the United States Navy after examination, and since that time I have been stationed at various navy-yards on the construction of buildings, wharves, coaling plants, dry docks, and other public works, and at the Navy Department, Washington, in the Bureau of Yards and Docks. While on duty in the Navy Department, from 1899 to 1903, in addition to other duties, I was in general charge of the designing of dry docks.

Mr. STEVENS. Where?

Mr. ROUSSEAU. Those being designed at that time were at Mare Island, Philadelphia, and Portsmouth navy-yards. In 1903 I was detailed for duty at the Mare Island Navy-Yard, in California, in charge of the public improvements in that yard, including the construction of a dry dock, the design of which I had been connected with, and also the improvement of the channel, dredging, quay wall, and cofferdam construction. In December, 1906, I was appointed Chief of the Bureau of Yards and Docks of the Navy Department, in charge of all navy-yard improvements under the Secretary of the Navy, which position I retained until I resigned in order to accept appointment as member of the Isthmian Canal Commission, in March, 1907.

Mr. STEVENS. When did you come down here?

Mr. ROUSSEAU. I have been down here since March, 1907.

Mr. STEVENS. Are you familiar with the foundation and structure of the Gatun locks and dam?

Mr. ROUSSEAU. Yes, sir.

Mr. STEVENS. How, in your professional experience, does the practicability and factors of safety of these locks and dam compare with the factors of safety of the public works of a similar character you have had charge of for the navy? Please give specific instances.

Mr. ROUSSEAU. The material on which the Gatun locks will be built is better as regards sustaining power than that on which three-fourths of the dry docks of the navy have been built. The only naval dock that has a better foundation is at the Portsmouth (N. H.) Navy-Yard, where granite was blasted out and the concrete and cut stone lining placed directly on solid granite. The pressures that a dry dock has to stand are of the same general character that the Gatun locks will have to withstand. The service is, perhaps, more severe on a dry dock than on a lock, because a lock normally contains water, is never pumped out except for examination or repair, and the resultant

pressure is downward, whereas a dry dock is completely pumped out every time a vessel is docked, which subjects it to the full existing upward pressure of the water on the bottom of the floor of the dry dock, which has to be balanced by the weight of the dock and its contents.

Mr. STEVENS. What are the principal elements which have to be considered as affecting or determining the thickness of the bottom of a concrete dry dock?

Mr. ROUSSEAU. The width of the dock on the floor, the depth of water to the bottom of the floor, and the alternations in the upward and downward pressures. The strain increases as the square of the width of the floor and is proportional to the depth of the water.

Mr. STEVENS. Now, with the dock empty, if you continue that upward pressure for, say, several days, and then fill the dock again, repeating the process at regular intervals, is there a tendency to develop any weakness in time, if this is kept up?

Mr. ROUSSEAU. It has been learned by experiments and careful investigation that concrete, steel, and other materials will fail under repeated or alternating pressures much more readily than when subjected to a constant stress in one direction. This is due to the development of innumerable and minute flaws or defects, and in the design of a structure subjected to these conditions proper allowance for same has to be made. With this provision such a structure will be equally safe and have as long life as a structure under a constant pressure.

Mr. STEVENS. Have there been any accidents on account of any weakness of the foundations of naval docks?

Mr. ROUSSEAU. The old type, the so-called "Simpson dry dock," was of wood instead of masonry. It was subject to all the limitations of life and strength of timber construction. These docks had wooden sides, backed with clay puddle, and clay puddle beneath the wooden floor. They were not designed to be water-tight. The seepage water was led to a sump. There was no upward pressure to withstand, and the seepage water was pumped out as it leaked in. No more of this type of dock are being built. There have been no failures of masonry docks due to the upward pressure. The only flaws that have developed in the concrete have been minor ones, due to changes in temperature, causing contraction cracks, and, with continued alternations of freezing and thawing, some spalling of the surface. In some cases the action of sea water under pressure has been unfavorable. The Gatun locks will not be subject to any of these elements, and the situation is an ideal one for the use of concrete. The possibility of damage to the Gatun locks from earthquakes has been advanced as a reason against a lock canal. Experience with dry docks does not support this reasoning. In 1898, the so-called "Mare Island earthquake" destroyed most of the buildings at the Mare Island Navy-Yard and some of the quay walls, etc., causing damage amounting to \$300,000. The granite-lined masonry dry dock there was uninjured, as was the vessel in same at the time undergoing repairs. Likewise the dock was uninjured in the San Francisco earthquake of 1906, and the private dry docks in the vicinity of San Francisco passed through the earthquake without injury.

Mr. STEVENS. What is the greatest water pressure you know of on and dry dock of the United States Navy?

Mr. ROUSSEAU. On the newer docks the maximum upward pressure is due to a head or depth of 55 feet; on others it varies from 45 to less than 55 feet.

Mr. STEVENS. Do you give any consideration to upward floor pressure, caused by seams or anything of that sort, in the material under the docks?

Mr. ROUSSEAU. The docks are all designed for the full upward pressure of the water, with the dock empty. Sometimes the concrete is reinforced with steel. To reduce the flow of water as much as possible, and the danger of erosion, it is customary to drive one or more lines of sheet piling across the entrance to the dock, extending same up into the concrete of the floor. Sometimes this water cut-off is continued around the dock. When concrete is laid on a rock foundation, as at Gatun, the adhesion between the concrete and the rock bottom will exert a powerful "holding-down" influence, and confine or localize the upward pressure of water arising from seams. With non-permeable rock no general or widespread uplifting water pressure could thus exist under the whole bottom. Should additional anchorage for the concrete floor be desired, it could be easily obtained through anchor bolts cemented into the underlying rock and extending up into the concrete floor. The water pressure under dock floors is observed and recorded by means of gauges attached to pipes built in the concrete and extending down to material underneath.

Mr. STEVENS. Have there been any accidents from the upward pressure?

Mr. ROUSSEAU. None whatever.

Mr. STEVENS. What is the size of the largest naval vessel that is liable to use these Gatun locks?

Mr. ROUSSEAU. The largest vessels being planned have a displacement of 25,000 tons. The dimensions have not yet been announced, but will probably not exceed 650 feet by 95 feet by 28 feet. The largest vessels of the navy built or building are 510 feet by 85 feet 2½ inches by 27 feet.

Mr. STEVENS. How much greater would the weight of such a ship be than the larger type of Soo freighter that passes through the Soo locks, which is about 600 feet long and carries about 12,000 tons of iron ore and upward?

Mr. ROUSSEAU. The battle ship would be considerably heavier.

Mr. STEVENS. How does the largest battle ship compare in length with a 625-foot freighter?

Mr. ROUSSEAU. It is shorter.

Mr. STEVENS. Does its length increase the difficulty of handling a vessel?

Mr. ROUSSEAU. Yes, sir; if the channel is narrow or shallow.

Mr. STEVENS. Do you apprehend any danger in handling those heavy battle ships through these locks?

Mr. ROUSSEAU. With ordinary and usual precautions and safeguards the danger should be much less than is undergone in docking and undocking them in a dry dock, which is a more hazardous and delicate operation.

Mr. STEVENS. So the experience of naval officers is such as to almost eliminate that danger?

Mr. ROUSSEAU. Yes, sir. To pass through the locks would hardly be considered a danger; it would be looked upon more as an inconvenience and delay.

Mr. ESCH. What is the greatest width across the floor of a dry dock?

Mr. ROUSSEAU. Ninety-six feet for the Puget Sound dock, including the lower wide altar; 80 feet and less for the older docks. The entrance is of greater width; it runs up to about 115 feet for the larger docks. The docks are closed by floating gates called caissons instead of the miter gates used on the canal locks.

Mr. ESCH. The canal locks are to be 110 feet wide?

Mr. ROUSSEAU. Yes, and have a usable length of 1,000 feet.

Mr. ESCH. In no case, then, where you have such a dock with a width of 80 feet and upward, have you had any difficulty?

Mr. ROUSSEAU. None whatever.

Mr. ESCH. Even where the dock has been built on permeable material?

Mr. ROUSSEAU. There has been no difficulty from upward pressure in any case.

Mr. ESCH. If you were to build such a floor, would you make use of the principle of the inverted arch for its construction?

Mr. ROUSSEAU. Yes; a concrete slab is used, 14 feet thick, for the largest docks, which acts as an arch in resisting upward pressure.

Mr. ESCH. In any of the docks have any fissures or cracks developed in the concrete material?

Mr. ROUSSEAU. Yes; due to contraction, caused by large variations in temperature.

Mr. ESCH. Well, that is eliminated on the Isthmus?

Mr. ROUSSEAU. Yes; the temperature of the water will probably never vary more than 10°.

Mr. ESCH. And you anticipate that the only cause for a fracture of the floor of a lock here would be due to imperfect material?

Mr. ROUSSEAU. The concrete of the locks can be made sufficient in amount and strength for the purpose without difficulty.

Mr. KNOWLAND. Is there any appreciable danger from the upward thrust of the water under the floor when the lock is full of water?

Mr. ROUSSEAU. No, sir; there is no upward pressure then; it is downward.

Mr. KNOWLAND. So any danger of that sort would occur either during construction or when the lock was empty thereafter?

Mr. ROUSSEAU. It would.

The CHAIRMAN. Would it necessarily be during construction?

Mr. ROUSSEAU. No, sir.

Mr. ESCH. What radius would be required by a 900-foot vessel going around curves?

Mr. ROUSSEAU. That would depend upon the speed and other considerations. The Board of Consulting Engineers reported on this matter in 1906, and the plans submitted with that report were based on a very thorough investigation of the requirements of ships and of the practice in other canals. I think the minimum radius reported was about three ship lengths for a speed of 9 miles per hour.

Mr. ESCH. What was the maximum length of ship on which these calculations were based?

Mr. ROUSSEAU. The largest vessels observed were those on the Great Lakes; about 600 feet in length.

Mr. ESCH. Would it be possible to accommodate a 900-foot vessel in this canal?

Mr. ROUSSEAU. Yes, and 1,000 feet, which is the capacity of the locks. The length of locks limits the size of vessels, not the channel width and alignment.

Mr. ESCH. In going through the Culebra cut, would there be any difficulty in navigating a vessel 900 feet in length?

Mr. ROUSSEAU. Not any more than in navigating a vessel of that size through any other 300-foot channel having a 45-foot depth and a maximum deflection angle of six degrees, such as exists in several places in Culebra cut where the canal changes in direction. At the points of deflection the additional excavation will be sufficient to permit the turns being made without danger.

Mr. ESCH. As you say, of course the danger would depend upon the speed?

Mr. ROUSSEAU. Yes.

Mr. ESCH. What would be the rate of speed?

Mr. ROUSSEAU. About $4\frac{1}{2}$ knots an hour for a vessel of the largest size.

The CHAIRMAN. At what rate of speed could a vessel of 95-foot beam enter a lock 110 feet wide?

Mr. ROUSSEAU. Not over 100 feet a minute.

The CHAIRMAN. What would be the direction of the displaced water?

Mr. ROUSSEAU. Some would go on either side and most of it underneath. Such a vessel would probably not draw over 30 feet, and there would be not less than 45 feet in the lock. I have seen vessels of the navy enter a dry dock with not more than a foot or two clearance on either side. In still water, with no strong wind, the direction of a vessel under such circumstances is very easily controlled.

The CHAIRMAN. The flow of water would then be much greater than the vessel?

Mr. ROUSSEAU. There will be no movement of the water when the lock gates are opened. The vessel just goes in and displaces so much water. The currents and eddies in the locks occur during filling and emptying them.

Mr. STEVENS. You have been in the navy and are familiar with the official course of business with your superior officers. As I recall, these plans of the Board of Consulting Engineers for a lock canal have come to you for execution. If you find, or should find, any defects that you should conceive to be fatal to the execution of these plans, what would you conceive to be your duty in informing your superior officers concerning it?

Mr. ROUSSEAU. I should consider it my duty to inform them at once, and, in fact, this has always been the idea of everyone connected with the work. So far as I am aware, this is the recognized procedure.

Mr. STEVENS. So that those of us who are concerned with the construction of this public work are sure that so far as the representative on the commission of the Navy Department is concerned, if he finds any defect that he regards as fatal to the execution of the work, he would conceive it to be his duty to report it at once to his superior officers?

Mr. ROUSSEAU. Yes, sir; I would.

STATEMENT OF MAJ. D. D. GAILLARD, U. S. ARMY.

Mr. STEVENS. Will you please give your name and official connection with the canal work?

Major GAILLARD. D. D. Gaillard; member of the Isthmian Canal Commission, and division engineer of the central division, extending from Pedro Miguel to Gatun. The Culebra cut has been in my charge since April, 1907.

Mr. STEVENS. So you have charge of what is popularly known as the "Culebra cut?"

Major GAILLARD. Yes; and also of what was formerly known as the Chagres division.

Mr. STEVENS. There are two questions about which we desire to be informed briefly concerning your work on the cut: The amount of excavation, the rate of excavation, the probability of finishing it; and, second, the danger of slides by which those vast hills on either side might slide into the cut, thus imperiling the work?

Major GAILLARD. There had been excavated in the central division 31,000,000 cubic yards up to January 1, 1909. There remain to be excavated in the central division after this date 54,000,000 cubic yards. Our rate of excavation in the central division at the present time is 18,000,000 cubic yards per annum, or 1,500,000 cubic yards per month. If that rate were maintained we would finish the excavation in a little over three years, but as the bottom of the prism becomes narrower we can not maintain that rate. It will probably take from four to five years to complete the excavation in the central division.

Mr. STEVENS. Will not the increased depth increase the probability of injury from possible slides?

Major GAILLARD. I think not, because all slides so far encountered have been superficial. They have been formed from the top layer of clay, which varies anywhere from 15 to 40 feet in depth. Only that top layer of clay has ever troubled us so far. We have had in all five slides, aggregating very close to 1,000,000 cubic yards. The worst ones are now quiet. We have removed the Cucaracha slide and the Paraiso slide; they were the two largest by far. Two others have also been removed, so that now we have only one causing any trouble—the one opposite the Whitehouse Yard, near Las Cascadas. There a large mass of earth about 20 feet in thickness is sliding toward the canal; 106,000 cubic yards are involved, and about half of that has been removed.

Mr. STEVENS. What danger may we expect in future, then, from slides of earth or rock?

Major GAILLARD. In Culebra cut I think the principal trouble from slides has passed. The worst ones have been taken away. We have developed no new slides below the level of rock. All of the work after May 1 of the present year will be in rock; so we see no reason to anticipate danger of new slides due to increased depth, but possibly places on top, until they get a growth of trees, weeds, and grass over them, which we will get quickly here when we stop digging, may develop superficial slides in the clay top surface layers.

Mr. STEVENS. You furnish some material for the Gatun dam?

Major GAILLARD. Yes; from three to five train loads per day, amounting to from 1,000 to 1,500 cubic yards.

Mr. STEVENS. Can you furnish all that will be needed, so far as you are informed, in the course of the construction of the dam?

Major GAILLARD. We can.

Mr. STEVENS. What danger may we apprehend from handling the Bas Obispo River in your section?

Major GAILLARD. I think none. I believe the critical stage of that work has passed with the close of the recent wet season. We will complete the Bas Obispo diversion about May 1—before the next wet season begins. That will cut off the water from the east side of the canal between Gold Hill and the Chagres River, near Gamboa.

Mr. STEVENS. So those two questions I asked you may be considered as answered; first, that the danger of slides is, or will be, eliminated as the work progresses.

Major GAILLARD. I do not think we will be annoyed by slides as much in the future as in the past. Slides have never been considered by us as offering any real obstacles to the construction of the canal.

Mr. STEVENS. I am speaking of the general and final execution of the plan; do you apprehend that those great hills will slide into the cut?

Major GAILLARD. No, sir; I believe that fear is without foundation on facts.

Mr. STEVENS. Have you bored and given investigation as to the possibility of that?

Major GAILLARD. There have been borings taken along the center line of the canal throughout the entire section I have charge of to a depth below sea level. These borings I have seen and studied. If the boring is a true sample, as I have reason to believe, the material does not differ materially from that you gentlemen saw the other day in the cut.

Mr. STEVENS. What will be the height from the lowest portion of the canal to the highest portion in the cut?

Major GAILLARD. There will be a place on Gold Hill on the east side slope of the canal that will be 494 feet above the bottom of the canal.

Mr. STEVENS. Is there any danger of slide from that point?

Major GAILLARD. None whatever, apparently. Gold Hill is formed of a very hard trap rock which stands vertically in terraces, left by the French twenty-five years ago.

Mr. STEVENS. Then the second question we consider as answered, you can complete that part of the work as speedily as the Gatun locks and dam can be finished?

Major GAILLARD. I feel practically certain that we can complete the work in our section, Pedro Miguel to Gatun, in ample time for the opening of the canal in 1915.

Mr. STEVENS. Did I ask you in regard to your previous professional experience?

Major GAILLARD. No, sir. I graduated at West Point in 1884. I was two and one-half years at the Engineer School of Application. From there I went as assistant on river and harbor and fortification work in the Florida district for four and three-quarters years. Then from February, 1892, to December, 1894, I was a commissioner on the Mexican boundary survey. In 1895 I was on forti-

fication work at Fort Monroe, Va. Early in 1896 I took charge of the Washington Aqueduct and raised the dam at Great Falls across the Potomac River, and remained on that duty until the outbreak of the war with Spain, in May, 1898. I served in the United States and Cuba until May, 1899. Then for four months I was detailed to design the substructures for the gatehouses on the New Aqueduct Tunnel in Washington. I was assistant to the Engineer Commissioner of the District of Columbia until February, 1901. Then I took charge of river and harbor work on Lake Superior until June, 1903. I was then detailed on duty with the General Staff of the army in May, 1903, and with the exception of a few months I remained on duty with the General Staff until March, 1907. I was serving in Cuba with the General Staff at the time of the disturbance there in 1906, and was appointed to duty on the Isthmus while serving in Cuba in February, 1907.

Mr. STEVENS. When did you come here?

Major GAILLARD. I arrived here March 12, 1907, with Colonel Goethals.

Mr. STEVENS. From all of your long and varied experience in engineering and military matters, if you found out in any way a defect in the present plans that you conceive would cause disaster, or imperil the success of the plans for building the canal, what do you conceive would be your official duty?

Major GAILLARD. My official duty would be to report it at once to Colonel Goethals.

Mr. HUBBARD. I would like to know whether any such report has been made at any time?

Major GAILLARD. I have made no such report. I have often spoken to him of slides, etc., but have had nothing that I considered vital or actually hurtful to report.

Mr. STEVENS. What is the height of the summit of Gold Hill above sea level?

Major GAILLARD. Six hundred and sixty-two feet.

Mr. STEVENS. You said a while ago 494 feet would be the highest point; that means not 494 feet above sea level, but 494 above the bottom of the canal as it will be when completed?

Major GAILLARD. Yes, sir.

Mr. STEVENS. Through the Culebra cut what is the slope or angle of the banks as they rest?

Major GAILLARD. From a 3 on 2 to a 45-degree slope, depending on the firmness of the material. Where the material is weakest, we make the slope not more than 1 on 1; i. e., 45 degrees.

Mr. HUBBARD. You say the faces of the terraces on Gold Hill remain nearly vertical, as the French left them. Can you depend on that—you think there will be no trouble from slides in that formation?

Major GAILLARD. I apprehend no trouble there; the material is hard trap rock.

Mr. CUSHMAN. How much did the French take out from the Culebra cut?

Major GAILLARD. The French took out about 23,000,000 yards, we have taken out 31,000,000 yards up to January 1, 1909, and about 54,000,000 remain to be taken out.

Mr. CUSHMAN. How long did it require the French to make that excavation?

Major GAILLARD. The old French company worked from 1881 until 1889; then the new company worked continuously in a small way until 1904—from 1881 to 1904.

Mr. KENNEDY. The Panama Railroad is to go through the cut?

Major GAILLARD. Yes—on the east side of the cut on a bench or berm, 10 feet above the surface of the water.

Mr. KENNEDY. A berm will prevent the sliding of material from the top of the banks into the prism of the canal, will it not?

Major GAILLARD. Yes; it will help to catch and retain material falling down the slope.

Mr. KENNEDY. Do you contemplate making more berms through the cut, aside from the one which is to accommodate the railroad?

Major GAILLARD. Yes; we have to in steam shovel work; the berms serve as roadbeds to reach the different levels of the cut.

Mr. KENNEDY. And a slide of earth from the upper portion—

Major GAILLARD. Would be caught somewhere, unless it were a very large one that would overrun the berms.

Mr. KENNEDY. The slides occur where the rock surface is inclined towards the prism?

Major GAILLARD. Yes; and nearly always where the clay top soil overlies a white, soapy rock, almost like soapstone. The water gets between the rock and the clay—the slide is entirely superficial. It never extends below the bottom of the clay.

Mr. STEVENS. You have not yet found any displacement of one stratum of rock over another?

Major GAILLARD. None whatever; always clay sliding upon rock or hardpan.

(The committee thereupon took a recess until 8 o'clock p. m.)

AFTER RECESS.

STATEMENT OF HON. H. A. GUDGER, CHIEF JUSTICE, CANAL ZONE JUDICIARY.

Mr. ESCH. How long have you been on the Isthmus?

Judge GUDGER. I was here eleven years on the 6th day of September, last.

Mr. ESCH. In what capacities have you acted?

Judge GUDGER. I was consul-general from the time I arrived up to the 24th of February, 1905, when I was made associate justice of the supreme court.

Mr. ESCH. You were made, then, associate justice?

Judge GUDGER. Yes, sir.

Mr. ESCH. You have recently been appointed, and qualified, as chief justice?

Judge GUDGER. Yes, sir.

Mr. ESCH. Were you connected at all here with any judicial system before?

Judge GUDGER. Not on the Isthmus; in the States, yes.

Mr. ESCH. The organization of the courts, as we understand it, is a supreme court, controlled by three justices, each of whom holds court on the circuit. Am I right?

Judge GUDGER. Yes, sir.

Mr. ESCH. The annual report shows the amount of business by these courts; first, that the supreme court disposed of 11 cases at 17 sessions held by the court. I take it that that is exactly correct?

Judge GUDGER. But that is not in the last year.

Mr. ESCH. It is in the year covered by the report?

Judge GUDGER. Yes, sir.

Mr. ESCH. I will be glad if you will supplement that statement by a report showing what has taken place since then.

Judge GUDGER. I have a complete record for the last year, ending the 1st day of this month, of all business transacted in the courts.

Mr. ESCH. Have you it at hand?

Judge GUDGER. Yes, sir. I have here a report of each circuit. Shall I read it?

Mr. ESCH. I will ask you to give the substance of it, please, and I will then ask you to file it.

(Full report appended hereto.)

Judge GUDGER. In the first circuit court, in the beginning of the year, we had 6 cases pending; cases filed during the year were 88; cases disposed of were 84, leaving 10 pending.

Mr. ESCH. You are speaking now of work in the several circuit courts?

Judge GUDGER. Yes, sir.

Mr. ESCH. Go on with the work in the second circuit court.

Judge GUDGER. Judge Duran was judge of the first circuit court. In the second circuit court, of which I was judge, at the beginning of the year we had 42 cases pending; cases filed during the year 353, 100 civil and 253 criminal; cases settled 327, leaving an apparent number of 68 cases unsettled, but really amounting to 3 cases.

Mr. ESCH. The cases having been dismissed?

Judge GUDGER. No; but some of them should have been dismissed. During December, 1908, the number of new civil cases filed and not at issue was 23; criminal cases filed and not at issue, 22; probate cases in the court, for which the time of settlement is not out, 9; civil cases tried in December, 1908, and judgment rendered since, 2; criminal cases where parties absconded, 2; criminal cases where defendant is in penitentiary on other charges, 2; there are 3 bills against them which we overlooked, but which show in the balance; cases to settle land title under arbitration award, no issue, 2; cases disposed of, except for final order under cession (a method of bankruptcy), 3, making a total of 65 and leaving a net balance of 3, exclusive of those not at issue. In the third circuit, under Judge Collins, there were 19 cases pending at the beginning of the year; 89 were settled during the year, and 98 cases were filed during the year, and at the end of the year 28 were pending, 20 of which were civil and 8 criminal. I have no data as to the probate cases to be disposed of, but there are some probate cases which could not be disposed of on account of the publication, etc. In the supreme court we had 5 cases pending at the beginning of the year; filed during the year, 12; cases disposed of during the year, 15; leaving on the 1st of January 2 cases pending and 2 more filed on that date but not docketed because the costs had not been paid, making a total of 4. A recapitulation of business done in the first, second, and third judicial circuits, and in the supreme court, during the year of 1908, is as follows: Number of cases on hand at beginning of year, 72; cases filed during year, 551;

cases settled during the year, 515; cases pending, subject to the notification I have made, 108.

Mr. ESCH. Does the statement discriminate between civil and criminal cases?

Judge GUDGER. Yes, sir; I have it discriminated on the records. The total of costs collected in the first circuit is \$1,514.40, consisting of criminal costs, fines, marriage licenses, and recording fees, because the officers are not only circuit judges but also probate judges, and the clerk is registrar of deeds; that is, he issues marriage licenses and records deeds in each circuit court.

Mr. ESCH. The clerk to the circuit court?

Judge GUDGER. Yes, sir; the clerk of the circuit court has a record of each one. The number of marriage licenses issued was 1,382.

Mr. ESCH. They are issued by the judges or by the clerks?

Judge GUDGER. By the clerks at \$2 each. The number of papers and deeds recorded in all the circuits was 242. These records will show how each one of these circuits compared.

Mr. ESCH. Can you give an idea of the percentage of the civil and criminal cases?

Judge GUDGER. Yes; they are about equal to 1 civil to 2 criminal.

Mr. ESCH. What is the nature of the civil litigation?

Judge GUDGER. We find but very few large cases; that is, what you call cases of magnitude. The jurisdiction of the district court is up to \$100, while that of the supreme court ranges from \$500 to \$10,000. I have just finished such a case in which the amount sued for was \$35,000, and the judgment entered was for \$7,000.

Mr. ESCH. How many days was the supreme court in session?

Judge GUDGER. I can not answer that; I did not bring a record of that kind.

Mr. ESCH. Then the statement does not show the number of days the supreme court or circuit courts were in session?

Judge GUDGER. No, sir; it does not; but I would say, approximately, the supreme court was in actual session not over a month during the year; I think about that would be a correct estimate. We meet four times a year.

Mr. ESCH. At what places do the circuit courts sit?

Judge GUDGER. The supreme court meets at Ancon. The first judicial court also meets here, the second at Empire, and the third at Cristobal.

Mr. ESCH. Listening to the figures you have given, it would seem that half of the whole business in the circuit courts is transacted in the second circuit court?

Judge GUDGER. More than half.

Mr. ESCH. The appeal lies practically from the circuit court to the supreme court, composed of three circuit judges?

Judge GUDGER. That is not only practically so, but entirely so.

Mr. ESCH. In the event of a divided court, I presume the decision below is affirmed?

Judge GUDGER. Yes, sir; by an understanding; but that has happened only once or twice.

Mr. ESCH. In the event of a satisfactory plan being devised for an appeal from the circuit court, what would you say as to the feasibility and propriety of having but one circuit court in the Zone?

Judge GUDGER. There are arguments favorable to it from my standpoint—that is, the one-judge system—but there are also arguments against it.

Mr. RICHARDSON. What is that?

Judge GUDGER. It might save expense. It would be beneficial, that alone being considered, but there are views of it in which that would not be beneficial. My reason for that statement is this: That judge could live only at one of the three places, and all persons who wanted a writ of habeas corpus, injunctions, or any paper requiring the signature of a judge, would have to go to his residence to get it. I am speaking of it now from a public standpoint.

Mr. RICHARDSON. Would the one-judge system be sufficient to expedite all the business of the public?

Judge GUDGER. Yes: in that case there would be no difference. The public justice would be attended to just as well. If you had a one-judge system, with a one-clerk system, there would be some objection in regard to the registration of deeds.

Mr. RICHARDSON. To be met in the same way?

Judge GUDGER. They would have to go to one place for the examination of records, etc.; but that is a matter I feel I have nothing to do with. It might affect me personally, and therefore I will not give an opinion. I will state frankly that the system we have, under all the conditions we have, is the best and cheapest system we can devise, taking the dispatch of business on one side and cheapness on the other.

Mr. RICHARDSON. Assuming that the work in the Zone, the judicial work, is not to increase, I wish you would say whether or not it could be discharged by one judge; that is, whether he would have time to attend properly to it?

Judge GUDGER. I am thoroughly satisfied that the business in the Zone will not increase, and, so far as trial of cases is concerned, that one judge can attend to all the business.

Mr. RICHARDSON. Does the second circuit court sit at Empire?

Judge GUDGER. Yes, sir.

Mr. RICHARDSON. How far distant is it from Ancon?

Judge GUDGER. Approximately 12 miles.

Mr. RICHARDSON. And from Colon?

Judge GUDGER. It is 35 miles.

Mr. RICHARDSON. So the greatest distance one would have to travel would be 35 miles?

Judge GUDGER. That is the greatest distance if the judge were sitting at Empire; that is, if the headquarters of the court were at Empire, which I imagine it would be.

Mr. KNOWLAND. How long would it take to travel from Colon to Empire?

Judge GUDGER. Well, if you get a train at the moment you want to start, it is only a distance of about one hour and thirty minutes.

Mr. KNOWLAND. And the fare, how much?

Judge GUDGER. I have never paid a fare on the railroad, so I can not say as to that.

Colonel GOETHALS. Five cents gold per mile; and it is 35 miles.

Mr. RICHARDSON. It would be as convenient here, would it not—the one-judge system—as in most rural districts of the United States?

Judge GUDGER. I do not think so. The one-judge system and cases being sent to the States from these courts would limit the question of a large number of appeals. Whether that can be met by persons coming here periodically from the States I do not know.

Mr. RICHARDSON. We will come to that later.

Mr. ESCH. Suppose there were one circuit judge, with that provision for appeal whereby a judge is designated to sit here once or twice a year for the purpose of hearing appeals, would that not give relief?

Judge GUDGER. That would give relief.

Mr. ESCH. You would not regard it as desirable that in that way the legal business of the zone should be brought in more direct touch with the legal business of the United States?

Judge GUDGER. I would not regard that as beneficial. One reason is that in all civil matters here we have a mixture of laws, the largest portion of which is Panamanian. We have inherited the laws of Panama, and in order that they should be decided to the best advantage it seems to me that a judge should study it diligently; and it seems to me that he would have to live here to enable him to do it, which would be better than coming here once a year. If that were done, the system might not be hurtful.

Mr. ESCH. The system of which you speak is substantially that of the civil law?

Judge GUDGER. Yes, sir.

Mr. ESCH. That prevails in Louisiana, and is administered where necessary by the circuit court of appeals which sits in New Orleans?

Judge GUDGER. Presumably so; but I have no knowledge as to that.

Mr. ESCH. That being the case, would there be much objection to the plan of the appeal of that particular circuit to judges who are more or less familiar with that system?

Judge GUDGER. Well, I really feel that I am not competent personally to decide or give an opinion on a question like that. I still adhere to the opinion that three men on the Isthmus to hear appeals who know the conditions, who study the people and the language, and who look into everything as it exists, are better able and qualified to render satisfactory decisions, not only to themselves, but to the public, than are men who come here only once a year and perhaps not the same man twice. That is my private opinion, and I do not believe that that system would be satisfactory.

Mr. ESCH. Is it your judgment that the bulk of the legal and judicial business will be that of persons who speak foreign languages and who are accustomed to the application of the civil law, or of people from the United States, who are accustomed to the common law and speak the English language?

Judge GUDGER. I think it is growing into a majority of people who use the English language, and in the course of several years will be more largely so than at the present time.

Mr. ESCH. The tendency is that way?

Judge GUDGER. Yes; I believe it is, and I have contended that we are gradually tending that way.

Mr. ESCH. I believe that is all I wish to ask.

Mr. RICHARDSON. The question of saving money would enter very largely into this transaction, in putting one judge at the head of the court on this zone, and giving charge of the matter of appeals to a federal judge unknown to them at all, who would come from the States

and sit among them. Do you think that that would conduce to economy or public contentment?

Judge GUDGER. I do not know how much they would allow that man. He would be a regular federal judge in the United States; he would come here with a salary of \$6,000 or \$7,000 a year. Do you think that would save money to the Government? I think the amount would be so small that it would not compensate for the other difficulties and troubles, and I say further that our judicial system, as a whole, is little expense to the Government. The expense of all our courts amounts to practically \$43,000, and the income from all sources in our offices amounts to \$33,983; I have the exact figures. There is a deficit of only \$9,017 as between our receipts and disbursements, and that includes salaries of all clerks connected with the courts, judges, interpreters, janitors, rent of buildings, actual running expenses, etc.

Mr. RICHARDSON. Then you do not think it can be more economically administered than now?

Judge GUDGER. That is my judgment.

Mr. HUBBARD. How many days in the year will be required to hear these cases of appeal to which Judge Richardson refers?

Judge GUDGER. I will say this: We try cases in this country more rapidly than is the case in the United States, because we have no juries, but we are handicapped by virtue of the fact that many of the litigants are Spanish, many of them French speaking, and a large number of Chinese, and these speak foreign languages, so we have to have interpreters. In the appeals to the supreme court we find that element in a great many cases, so that sometimes it is not a question of the amount involved, as to how much time and how much care should be taken with regard to the decision, but there are other elements that enter into it. My experience on the bench has been that with the exception of a few cases the question of the amount involved does not cut a very great figure on this zone. In truth, I have found people who sued for two or three hundred dollars who felt just as much interest as other men who sued for \$20,000, but at the same time our system does not allow that to be a reason for appeal. I simply give it as my opinion that our system of three judges, for cheapness and efficiency, is the best system that can be devised for the zone. I do not speak of the personnel, but of the system.

The CHAIRMAN. Judge, I noticed in the report for the second circuit that the criminal cases filed during the year amounted to 253. What is the character of these cases?

Judge GUDGER. Well, we have the district judges, who have jurisdiction of all misdemeanors, and they have binding power in all felonies, larcenies, burglaries, and capital cases. We have at least four of that last, two pending in that circuit—two for execution and two for trial, and various other felonies.

The CHAIRMAN. What proportion of them are trivial cases, petty assaults, etc.?

Judge GUDGER. We have no jurisdiction in assaults.

The CHAIRMAN. Of the 100 civil cases filed during the year, in how many of them was there a demand for judgment for more than \$100?

Judge GUDGER. They could not bring a suit unless the amount was for more than that.

The CHAIRMAN. There were 67 civil cases decided and 19 dismissed?

Judge GUDGER. Yes, sir. Our object has been to have our people try the cases. The life of a criminal case in our courts is about three weeks from the time the crime is committed until it is out of court; that is, not a capital case. The civil cases must be tried or the parties must get out of court within a reasonable time, but there are three cases now on the docket which have been there for two or three years. We have made every exertion to have them tried or dismissed within a reasonable time.

The CHAIRMAN. In how many of the 67 cases decided was a judgment rendered in excess of \$100?

Judge GUDGER. I am satisfied that there was not 5 per cent for less than \$100.

The CHAIRMAN. In your judgment, as nearly as you can estimate, what would be the aggregate amount of judgments in the 67 cases?

Judge GUDGER. That would simply be a case of speculation, but I would imagine something like \$700.

The CHAIRMAN. An average, that?

Judge GUDGER. Yes; it might not go that much. I do not know, because I have not taken notes of that view of it. It is a guess purely, but I can get that information and give you the amount of every judgment.

(Statement appended hereto.)

The CHAIRMAN. Your dockets, of course, will show the amount of money collected under execution, the amount of judgment, and the amount of collections on execution?

Judge GUDGER. You want the satisfactions?

The CHAIRMAN. I want more than that. I want to see what amount was actually collected upon process.

Judge GUDGER. I do not think a very large amount was actually collected that way.

Mr. RICHARDSON. You say there is a murder case on that docket?

Judge GUDGER. Yes, sir; we have two, one that will be tried and one that is already sentenced. These are tried in the circuit courts, and then it goes up before the supreme court.

Mr. KENNEDY. When was that executive order issued regarding the jury trials for murders?

Judge GUDGER. About a year ago.

Mr. KENNEDY. Have you had any trials by juries?

Judge GUDGER. Yes, sir.

Mr. KENNEDY. Have you had trouble securing juries?

Judge GUDGER. Yes, and no. We have had trouble in securing jurors because they are taken from among the employees of the commission, and every man here is a busy man; he has duties to perform, and that he should perform, and when you take a foreman from over 20 men and leave his 20 men without anybody to report to, naturally he does not like it. A juror is allowed \$2 per day, if not an employee; if an employee, he is not allowed anything; he simply goes on his pay, which is to his advantage. From that standpoint there is a little trouble; it breaks into the work, and that is what I mean when I say there is trouble in selecting jurors.

Mr. BARTLETT. Why should you not pay a man in the commission as well as another?

Judge GUDGER. We pay what the law says.

Mr. BARTLETT. But we want to find a way of remedying the law.

Judge GUDGER. Well, I presume by order of the commission we give them a salary during the time their services are required as jurors. As I said before, I think there are only two instances in which jurors claimed fees.

Mr. HUBBARD. Are there any stated hours for the sessions of the court?

Judge GUDGER. No, sir; there are office hours.

Mr. HUBBARD. That is, for the judges?

Judge GUDGER. Yes, and no.

Mr. HUBBARD. If your court is in session for the trial of cases, how many hours is it sitting per day?

Judge GUDGER. When I go to Empire I get up at 5.30 and take the 6.30 train, and get back at 7 o'clock p. m. I put in the time, and you can count the time as you please. I say the judges do not have office hours really, but if they are not in court they can be found at their places of business or in their homes.

Mr. HUBBARD. My question refers more to the days on which you are trying cases.

Judge GUDGER. If I go to-morrow morning to Colon, should I get through the cases in the morning at 12 o'clock, and there is a train I can come home on I take that; and if I get through at 3 o'clock, I come home at 4.30, which is the last train.

Mr. HUBBARD. Would you do that in the event there is a case ready for trial on the morning of the next day?

Judge GUDGER. You mean where there is no other business?

Mr. HUBBARD. Yes, sir.

Judge GUDGER. We never leave the court with uncompleted business unless night comes.

Mr. HUBBARD. Have you any right to fix the time for trial?

Judge GUDGER. Yes; at any time I want to. We try to fix our cases so as to interfere with the work as little as possible. The most of our witnesses and a large number of our litigants on both sides are employees of the canal, and we always have in view in fixing the time of these cases the taking of the least time possible to take these men from their work. We feel that we are here for the building of the canal. Of course civil government is necessary, but the real business is the building of the canal, and we don't want to interfere with the building of the canal more than we can help.

Mr. ESCH. Did the executive order establishing a system of juries on the zone fix the qualifications of jurors?

Judge GUDGER. Yes, sir. They should be able to read and write the English language.

Mr. ESCH. Under these qualifications do they not have to be citizens of the United States?

Judge GUDGER. No, sir. They have to reside here a period, I think, of three months.

Mr. ESCH. And practically only your American employees on the Zone have been accustomed to the jury system?

Judge GUDGER. Yes, sir; that is true.

Mr. ESCH. How is it in the island of Jamaica?

Judge GUDGER. Well, I do not know. I think they have a jury trial there, but I do not think the colored Jamaicans sit on juries.

Mr. BARTLETT. There is a system of trial by jury there.

Judge GUDGER. Well, I have not been in Jamaica, and I can not say as to that.

Mr. HUBBARD. Judge, I will ask you to file, for the same period covered by the statement you have already filed, a statement showing the number of days on which the circuit judges sat for trial of jury cases, if you can do that?

Judge GUDGER. Yes, sir.

(Statement appended hereto.)

The CHAIRMAN. Judge, did you not speak of five other judges—other than the supreme court judges?

Judge GUDGER. Yes, sir. [Reads from report.] I see that in the first circuit Judge Duran sat 88 times, as given in the report of that circuit. It does not give it in mine, or in Judge Collins's.

The CHAIRMAN. Did you speak of five other judges?

Judge GUDGER. Yes, sir. I spoke of the district judges. They answer to justices of the peace in the States, with a little more extension of powers.

The CHAIRMAN. What is their jurisdiction?

Judge GUDGER. They have jurisdiction in all misdemeanors where the fine does not exceed \$100 and the punishment thirty days. If the statute punishes a man for forty days or there is \$200 fine they would have no jurisdiction.

The CHAIRMAN. I understand you have two men under sentence of death and two to try?

Judge GUDGER. Yes, sir. We have the Coulson case, which we understand has been remanded because the United States Supreme Court has no jurisdiction. He was tried without a jury and sentenced to be hanged. The mode then in force was that he be tried for his life by a circuit judge and one of the district judges, and by one of the tax collectors, who was at that time called an alcalde or mayor, the defendant having the right to object to any of these.

The CHAIRMAN. And how was the other tried?

Judge GUDGER. The other was tried in the same way.

The CHAIRMAN. There were two men sentenced to death not tried by juries?

Judge GUDGER. Yes, sir.

The CHAIRMAN. And one to be hung Friday?

Judge GUDGER. I understand it is to be postponed.

The CHAIRMAN. Who postponed it?

Judge GUDGER. Colonel Goethals. Isn't that right, Colonel?

Colonel GOETHALS. Yes; I postponed it this morning. I am acting governor in Governor Blackburn's absence.

Judge GUDGER. Then we have executed one man from that district who was tried by a jury.

Mr. BARTLETT. You had juries of twelve?

Judge GUDGER. Yes, sir.

Mr. BARTLETT. And that jury system has been inaugurated by reason of an executive order of the President. How long since was it?

Judge GUDGER. I think about a year ago.

Mr. BARTLETT. Does that order limit the kind of cases in which a jury trial may be had?

Judge GUDGER. It says all capital cases.

Mr. BARTLETT. Then you can inflict imprisonment for a number of years here?

Judge GUDGER. Yes, sir. The law on the subject is peculiar; if he desires to do so, a man charged with murder can plead guilty of murder in the first degree, then the highest punishment that can be inflicted is a life sentence.

Mr. HUBBARD. I do not know whether I understand you correctly or not; do you say a man indicted for murder in the first degree might, of his own option, avoid capital punishment by pleading guilty of murder in the first degree, the punishment for which is imprisonment for life?

Judge GUDGER. Yes, sir.

Mr. HUBBARD. So you can not hang a man unless he wants to be hung?

Judge GUDGER. He has the right—further, if a man is convicted of murder in the first degree, the judge, of his own motion, may reduce it without setting aside the verdict.

Mr. KENNEDY. Does your code compel you to give counsel?

Judge GUDGER. We are compelled to give a man counsel when he is unable to employ one, unless he objects.

Mr. KENNEDY. Who pays him?

Judge GUDGER. Nobody; it is a courtesy of the bar. When a man comes into court, if he has not an attorney I ask him if he wants one, and if he does I assign an attorney to his case. If he says he does not want an attorney I do not give him a counsel, and I try to give him justice myself. We do not try anybody without counsel if he wishes it. I have not heard an attorney make the slightest objection to appear for a man under these circumstances.

Mr. BARTLETT. There is no provision for appeal from this court for them in any criminal case?

Judge GUDGER. I understand that a decision of the United States Supreme Court is that there has not been any provision made for allowing an appeal in criminal cases.

Mr. BARTLETT. Can you take a man out by a writ of habeas corpus?

Judge GUDGER. Yes.

Mr. RICHARDSON. What are your rules for admission to the bar?

Judge GUDGER. In Panama any lawyer who was practicing regularly on the 26th of February of 1904, I think, is admitted to practice law if he can prove that he is of good moral character. Any man in the United States who can practice in a state or territorial court is admitted on the same proof. Others that wish to be admitted are examined on a course laid down by the supreme court. I think we have admitted only one person in that manner.

Mr. BARTLETT. You have no jury trials in common-law suits?

Judge GUDGER. No; the only two cases are capital cases and trials for life.

Mr. BARTLETT. But you have common-law cases, of course?

Judge GUDGER. These cases are decided by the judge.

Mr. BARTLETT. By one judge?

Judge GUDGER. Yes; but they can appeal to the next higher court sitting en banc.

Mr. BARTLETT. Do you not think that questions of fact would be more satisfactorily settled by juries?

Judge GUDGER. Like every lawyer, I have ideas similar to those you express. In theory, I believe in it. Practically, and as to its application to the Canal Zone, I do not believe in it. The conditions here are such that I believe that one judge trying a case would be more satisfactory to the litigants and to the public than a jury system would be. The truth is, I believe the jury system on the Canal Zone for all the cases I am talking about would be a failure. I have my reasons, if the committee want to know them. Personally, as a judge, I would prefer to have a jury; I would prefer some one else to take the responsibility of deciding the facts.

Mr. BARTLETT. The qualifications of a juror are that regardless of citizenship he should be able to read and write the English language?

Judge GUDGER. I do not know whether his being able to write comes in, but he should be able to speak the English language. Most of the people who can write and speak English are Americans.

Mr. BARTLETT. The same class of people that constitute juries in the state and federal courts, are they not?

Judge GUDGER. Yes, sir.

Mr. BARTLETT. And if that system is good for the state and federal courts in common lawsuits, it ought to be good here?

Judge GUDGER. I do not think so, for we have here the Spaniards, Jamaicans, and Chinese, and I do not think that class of people, as a class, would as leave be tried by a jury as they would by a judge, whom, I think, they would look up to a little more, and feel that he was a little more interested in administering justice to them, and I think there is a little more feeling here than in some parts of the United States. However, that is my opinion. That may not be correct, and I simply give it as my opinion. I believe in the jury system, but I do not think it is applicable to the people here.

Mr. RICHARDSON. Where do you record titles?

Judge GUDGER. We record titles in Ancon, Empire, and Cristobal, where there is a registrar who records these titles.

Mr. RICHARDSON. Is he an appointed officer?

Judge GUDGER. Yes, sir. He is the clerk of the court, who is appointed by the judge, with the approval of the governor.

Mr. RICHARDSON. Are wills recorded in the same way?

Judge GUDGER. Yes, sir.

Mr. KENNEDY. In criminal offenses committed near Panama, would the circuit court here have jurisdiction—could the action be maintained in any one of the circuits, or would the crime be tried in any other circuit?

Judge GUDGER. In criminal cases it must be tried in the circuit in which the crime is committed.

Mr. KENNEDY. Have you surveyed and defined the bounds of that jurisdiction?

Judge GUDGER. Yes, sir. We have never had a question about it yet, but he must be tried in the circuit where the crime is committed.

Mr. KENNEDY. Have you had any conflict of jurisdiction during the past between the Canal Zone government and the Panamanian Government?

Judge GUDGER. No, sir. In the courts, none absolutely. I do not know otherwise. Everything has moved along as smoothly and pleasantly as could be.

The CHAIRMAN. You see no reason to apprehend any?

Judge GUDGER. None, that I know of.

REPORT.

CIRCUIT COURT, FIRST JUDICIAL CIRCUIT OF THE CANAL ZONE.

JUDGE DURAN.

[For months of January to December, 1908.]

Cases pending first of year.....	6
Civil.....	1
Criminal.....	5
Cases filed during year.....	88
Civil.....	7
Criminal.....	81
Cases settled during year.....	84
Civil.....	6
Decided.....	3
Dismissed.....	3
Criminal.....	78
Acquitted.....	9
Dismissed.....	3
Convicted.....	43
Habeas corpus.....	1
Nolle prossed.....	22
Cases pending last of year.....	10
Civil.....	2
Criminal.....	8
Probate cases pending first of year.....	5
Probate cases filed during year.....	16
Probate cases settled during year.....	7
Probate cases pending last of year.....	14
Number of sessions of court.....	88
Number of marriage licenses issued.....	150
Number of deeds recorded.....	21

Costs collected.

Civil costs.....	\$108.80
Criminal costs.....	31.85
Fines.....	597.00
Forfeitures.....	400.00
Marriage licenses.....	300.00
Recording fees.....	7.90
Notarial fees.....	23.00
Miscellaneous.....	45.85
Total.....	1,514.40

Of the 8 pending criminal cases, 1 was filed during November, but the defendant absconded and bail was forfeited January 4. The 7 other cases were all filed during December.

WALTER EMERY,
Circuit Court Clerk.

CIRCUIT COURT, SECOND JUDICIAL CIRCUIT OF THE CANAL ZONE.

JUDGE GUDGER.

For months of January to December, 1908.

Cases pending first of year.....	42
Civil.....	29
Criminal.....	13
Cases filed during year.....	353
Civil.....	100
Criminal.....	253

Cases settled during year.....	327
Civil.....	86
Decided.....	67
Dismissed.....	19
Criminal.....	241
Acquitted.....	55
Convicted.....	136
Dismissed.....	24
Nolle prossed.....	23
Habeas corpus.....	1
Withdrawn.....	1
Change venue.....	1
Cases pending last of year.....	68
Civil.....	43
Criminal.....	25
Cases tried during month.....	0
Civil.....	0
Criminal.....	0

Costs collected.

Civil cost.....	\$990. 46
Criminal costs.....	211. 35
Criminal fines.....	997. 00
Forfeitures.....	1, 250. 00
Miscellaneous fees.....	24. 90
Escheat.....	192. 95
Marriage licenses (945).....	1, 890. 00
Notarial fees.....	86. 40
Instruments recorded (143).....	71. 65
Total.....	5, 714. 71

Explanation.

Cases, criminal and civil, pending January 1, 1909.....	68
During December, 1908, new civil cases filed and not at issue.....	23
During December, 1908, new criminal cases filed and not at issue.....	22
End of year, probate cases, time of settlement not out.....	9
Civil cases tried in December, 1908; judgment January, 1909.....	2
Criminal cases where parties absconded.....	2
Criminal cases where defendant is in penitentiary on other charges.....	2
Cases to settle land title under arbitration award, no issue.....	2
Cases disposed of, except final order under cession.....	3
	65
Making an actual balance of cases, civil and criminal, on hand and at issue and not tried during the year.....	3

E. M. GOOLSBY, Clerk.

CIRCUIT COURT, THIRD JUDICIAL CIRCUIT OF THE CANAL ZONE.

JUDGE COLLINS.

For months of January to December, 1908.

Cases pending first of year.....	19
Civil.....	13
Criminal.....	6
Cases filed during year.....	98
Civil.....	26
Criminal.....	72
Cases settled during year.....	89
Civil.....	19
Decided.....	12
Dismissed.....	7

Cases settled during year—Continued.

Criminal.....	70
Acquitted.....	9
Convicted.....	47
Nolle prossed.....	12
Appealed.....	2
Cases pending last of year.....	28
Civil.....	20
Criminal.....	8
Number of marriage licenses issued.....	287
Number of deeds recorded.....	78

Costs collected.

Civil costs.....	\$204.54
Criminal costs.....	78.75
Fines.....	269.00
Forfeitures.....	75.00
Marriage licenses.....	574.00
Recording fees.....	21.96
Miscellaneous.....	296.80
Total.....	1,520.05

NELSON R. JOHNSON,
Circuit Court Clerk.

SUPREME COURT OF THE CANAL ZONE.

For months of January-December, 1908.

Cases pending first of year.....	5
Civil.....	3
Criminal.....	2
Cases filed during year.....	12
Civil.....	6
Criminal.....	6
Cases settled during year.....	15
Civil.....	8
Criminal.....	7
Cases pending last of year.....	2
Civil.....	1
Criminal.....	1

NOTE.—Two more cases filed, but not docketed, because costs were not paid until after January 1.

Costs collected.

Civil costs.....	\$96.00
Total.....	96.00

WALTER EMERY,
Clerk of Supreme Court.

RECAPITULATION.

Recapitulation of business done in the first, second, and third judicial circuits and the supreme court during the calendar year 1908.

Cases pending first of year.....	72
Cases filed during year.....	551
Cases settled during year.....	515
Cases pending last of year.....	108

Total collections.

Civil costs.....	\$1,399.80
Criminal costs.....	321.95
Fines.....	1,863.00
Forfeitures.....	1,725.00
Marriage licenses.....	2,764.00
Recording fees.....	101.51
Miscellaneous fees.....	669.90
Grand total.....	8,845.16
Marriage licenses issued during year.....	1,382
Documents recorded during year.....	242

Regarding cases pending last of year, see note on separate report of the second circuit.

CIVIL CASES DISPOSED OF IN 1908 INVOLVING JUDGMENTS IN THE SECOND JUDICIAL CIRCUIT.

Thirty-eight cases; total amount of judgments.....	\$14,598.79
Estate of Yet King.....	2,260.37
Total.....	16,859.16

NOTE.—The other of the 86 civil cases disposed of during the year in the second judicial circuit were where the defendant got judgment for costs or where the action was for a cause other than a money demand.

CAPITAL CASES FOR 1908.

First circuit, 2 cases; jury engaged two days.
 Second circuit, 4 cases; jury engaged six days.
 Third circuit, 1 case; jury engaged two days.
 Total, 7 cases; juries engaged ten days.

NOTE.—Second circuit court: 1 case tried before jury system was inaugurated, 1 case pending, set for trial January 30, 1909; 1 case nolle prossed since January 1, 1909.

STATEMENT OF MR. TOM M. COOKE.

Mr. ESCH. Please give your full name and your office.

Mr. COOKE. Tom M. Cooke, collector of revenues.

Mr. ESCH. You are under Senator Blackburn?

Mr. COOKE. I am under the chairman; my division belongs to the department of civil administration.

Mr. ESCH. That department, as I understand it, has jurisdiction over customs, post-offices, police, fire department, and common schools?

Mr. COOKE. Yes, sir; customs, post-offices, lands, administration of estates, and internal revenue, belong to my division—the others are in the department of civil administration.

Mr. ESCH. We want to direct our inquiry to the administration of the land department.

Mr. COOKE. That is in the division of revenues.

Mr. ESCH. You have knowledge of that?

Mr. COOKE. I have charge of that.

Mr. ESCH. What is the superficial area, in miles, of the Canal Zone?

Mr. COOKE. Five miles on either side of the axis of the center line of the canal and forty-seven and a fraction miles long.

Mr. ESCH. How much of that tract is so-called government land?

Mr. COOKE. We own by the original purchase about 52 square miles. We have purchased in the past few years about 3 or 4 square miles more. There are about 188 square miles that we have jurisdiction over, received by our treaty with Panama. The Panama Railroad Company owns—I am not giving exact figures—about 70 square miles; and about 135 square miles are in private ownership.

Mr. ESCH. Does your department control the lands of the Panama Railroad?

Mr. COOKE. No, sir; they have their own land department.

Mr. ESCH. You say 135 square miles are in private ownership?

Mr. COOKE. About that.

Mr. ESCH. Then the balance would represent the public lands of the Canal Zone?

Mr. COOKE. Not entirely. We have title to about 55 square miles, by purchase; then there are some public lands which were public lands of Panama when the treaty was made. We have absolute jurisdiction over this land, as far as the treaty gives us, but I am not prepared to say we own it.

Mr. ESCH. Who does, if the United States does not?

Mr. COOKE. The treaty, I believe, uses the words they grant us "jurisdiction in perpetuity" of this land.

Mr. ESCH. But are there no private owners for these lands?

Mr. COOKE. No; there is no claim of ownership.

The CHAIRMAN. It is public land, just as in the western part of our country?

Mr. COOKE. Yes, sir.

Mr. ESCH. What is the extent of that, approximately?

Mr. COOKE. About 188 square miles.

Mr. ESCH. You mean to say there is no land within the limits of the Canal Zone of private ownership?

Mr. COOKE. I have said there are about 135 square miles.

Mr. ESCH. Take the savannas. That is in the Canal Zone. Are they in private ownership?

Mr. COOKE. Yes; the commission owns no land in the savannas.

Mr. ESCH. Are there not a good many squatters in the Canal Zone who claim titles by reason of limitation?

Mr. COOKE. There are some.

Mr. ESCH. What have you done with those?

Mr. COOKE. As rapidly as we could pick up titles we have adjudicated them. Sometimes they have been able to prove occupancy.

Mr. ESCH. If they do prove occupancy for twenty years they have a valid title?

Mr. COOKE. I do not know the necessary term of years; I do not know what the holding of the court would be.

Mr. ESCH. There are some such people as that in the Zone?

Mr. COOKE. Yes, sir.

Mr. ESCH. Let us take up your administration of the lands owned in fee simple and those for which we have grant by virtue of the treaty. How do you dispose of such lands?

Mr. COOKE. We lease them under the authority of an act of Congress under date of July 28, 1892, for a period not to exceed three to five years.

Mr. ESCH. That is the existing statute? Would you advise an extension of the term of lease?

Mr. COOKE. I would. Where it is possible to lease a man some land, a longer period will allow him opportunity to put in permanent improvements—to open up the land and cultivate it. In many instances, under the present terms of lease, unless he is sure of a continuation of it, he does not have time to put in and gather a crop.

Mr. ESCH. In other words, it is difficult to prepare the ground and secure a crop in the time allowed?

Mr. COOKE. Yes; they would plant sugar cane, which does not become a valuable crop within a year. It would be a good plan to extend the term of lease where the engineering department could advise that the land would not be needed for construction purposes. Up to this time that has not been possible.

Mr. ESCH. In your opinion, what should be the maximum term of such lease?

Mr. COOKE. I should think fifteen to twenty years.

Mr. ESCH. You think you would secure more applicants?

Mr. COOKE. More, and better ones.

Mr. ESCH. To what extent have the people here taken advantage of the existing law?

Mr. COOKE. Very little. We have about 1,600 to 1,800 leases out.

Mr. ESCH. Have you put a limit on the amount of a leasehold?

Mr. COOKE. No, sir.

Mr. ESCH. You mean to say a man can secure a lease for any amount of land?

Mr. COOKE. If he pays for it.

Mr. ESCH. Would you not think it better to limit the amount of a leasehold interest?

Mr. COOKE. A discretionary limit might not be a bad thing. If some concern desired to come down here and colonize, it would force them to cut up their leases. The people here do not lease a large amount of land, because they have not the energy to cultivate it. Lengthening the term of the lease and reducing, probably, the rental value of the land might bring a better class of persons down here to lease.

Mr. ESCH. What is the unit of land here?

Mr. COOKE. The hectare—about $2\frac{1}{2}$ acres.

Mr. ESCH. You think a limit of 20 to 40 hectares would be an inducement to take out leaseholds?

Mr. COOKE. It would not be an inducement to the people here; they lease only small portions of land—1, 2, 3, 4, or 5 hectares.

Mr. ESCH. In such a lease would you provide, in case the Government required those lands, an award of damages should be made?

Mr. COOKE. At the present time we provide for the entry of the Government at any time without indemnity; and the lease provides that the holder shall remove the property that belongs to him without cost to the Government, and in case he does not do this within a stipulated length of time the Government does so at the cost of the person.

Mr. ESCH. By not providing indemnity you tend to discourage leasing. That and the short term are the reasons why so few take advantage of the law?

Mr. COOKE. I think so. In the past it has not been possible to lease land with any certainty of tenure, on account of the construction going on.

Mr. ESCH. Do you think the construction of the canal has so far advanced, and the limits of the Gatun lake are now so definitely fixed, that we can locate land available for lease, and so are in position to enact a more liberal law with respect to leaseholds?

Mr. COOKE. I think Colonel Goethals could answer that question better than I.

(The question is repeated to Colonel Goethals.)

Colonel GOETHALS. Yes, sir.

Mr. ESCH. And that therefore now would be an opportune time for formulating a law liberalizing leasehold interests?

Colonel GOETHALS. Yes, sir.

Mr. ESCH. When the Government acquired the rights in the Canal Zone, extending five miles on either side of the center line of the canal, it was not then known what the limits of the Gatun lake would be, or whether there would be any lake; I notice in looking at the map now that the limits of the lake will extend beyond the width of the Canal Zone. What has the Government done in reference to acquiring land at those places beyond the limits of the zone?

Colonel GOETHALS. Where the ownership of that land has been determined the question has been submitted to the land commission, or the general counsel for the commission has made arrangements to purchase that land.

Mr. ESCH. Has there been any condemnation, or anything of that kind?

Colonel GOETHALS. The land commission is in the nature of a condemnation; and the canal boundaries are now fixed after a survey with the American engineers and the Panamanian engineers, represented in a party which determined and marked the boundary lines of the Zone.

Mr. ESCH. And those lines as now laid out project beyond the original 5-mile limit?

Colonel GOETHALS. No; they project right through the lake 5 miles on either side of the center line of the canal. Part of Article II of our treaty with Panama grants to the United States the use, occupation, and control of any other lands and waters outside of the 5-mile limit which may be necessary for the construction and maintenance of the canal or auxiliary works.

Mr. ESCH. That would carry with it the right to overflow; and that language also would give us the right to go out there to build a dam or other auxiliary works?

Colonel GOETHALS. Anything that is necessary for the construction of the canal.

Mr. ESCH. Making proper compensation?

Colonel GOETHALS. Yes, sir; under that provision of the treaty we are getting stone from Porto Bello; we are getting sand from Nombre de Dios, on the Caribbean, and we purpose getting sand from Chame, on the Pacific side.

Mr. KENNEDY. Under the existing law, what are the qualifications of an applicant for a leasehold?

Mr. COOKE. None, except that a form of lease approved by the Secretary of War is used. The man pays his \$3 per hectare in advance.

Mr. KENNEDY. That is the amount of rent you now charge?

Mr. COOKE. Yes, sir: \$3 per hectare per annum.

Mr. ESCH. In your opinion, would it be wise in framing a law for leaseholds in the Canal Zone to put in certain qualifications?

Mr. COOKE. Yes, sir.

Mr. ESCH. What should be some of these qualifications?

Mr. COOKE. Well, the purpose for which the land is leased, the character of the lessee, etc.

Mr. ESCH. Would you require an affidavit from him that he is an actual resident and intends to remain such—and for his sole benefit?

Mr. COOKE. Yes, sir; and that the land will be used for purposes set forth in the lease, to avoid anyone coming in here and securing a large amount of land to hold for speculative purposes.

Mr. ESCH. Would you allow leases to be transferable?

Mr. COOKE. No, I would not, without the consent of the Government. Of course, circumstances might arise in which transfer of the lease would be necessary—in case of death, etc.

Mr. ESCH. Would you have the same fixed price per hectare, or would you vary it according to the quality of the land?

Mr. COOKE. I think it ought to be varied according to the quality of the land, its location, nearness to market, availability for grazing, and expense of clearing it.

Mr. ESCH. Has there been any difficulty in giving new lands to owners in fee in the tract that is to be submerged by the lake?

Mr. COOKE. That is a question I think either the chairman or the general counsel could answer. I do not know what difficulty they have had.

Mr. ESCH. They would have a certain vested right, of course. You are going to take their lands away from them, and they may not care to take cash, but may prefer other lands. If there is not now authority for the transfer of land already owned by the United States in lieu of lands taken from them, that authority should be given. Would there be enough land in the Zone to take care of such titles?

Mr. COOKE. I can not answer that question. I do not know how many acres of private land will be submerged.

Colonel GOETHALS. Mr. Rogers contemplated a year ago an arrangement with the owners of land that will be submerged to take an equal section of land bordering the lake, and he proposed to arrange the distribution so that the Government would have the alternate sections. From that I imagine he concluded there was sufficient land bordering the lake to accomplish the purpose.

Mr. ESCH. Now, of the 135 square miles in private ownership, are there any lands to which titles can be questioned?

Mr. COOKE. That question has not come up except where the Government has needed the land, and then the title has been investigated.

Mr. ESCH. On such investigations, has the title been found to be reasonably perfect?

Mr. COOKE. Yes, sir.

Mr. ESCH. Do you infer, because of that fact, the same thing would be true of private lands generally?

Mr. COOKE. Possibly so. They have been in possession for a long number of years, and they have submitted many of their titles. The titles were unquestioned by Panama.

Mr. ESCH. In giving leaseholds, would you give preference to the present occupant, even though he might be a squatter?

Mr. COOKE. No, I would not. If the plan is intended to develop this country, the present holder of the lease probably would not be desirable.

Mr. ESCH. You think that whatever law we should frame ought to confer a good deal of discretion on the person who is to administer it?

Mr. COOKE. Here—yes, sir. Your committee has had under consideration a bill introduced by Representative Mann; I have had a copy of that bill. That bill provides, I think, for a lease of twenty-five years under certain provisions.

Mr. ESCH. Would you reserve mineral, gas, and oil rights?

Mr. COOKE. That bill does.

Mr. ESCH. Has there been much transfer of private land among people here since we acquired possession?

Mr. COOKE. Very little.

Mr. ESCH. If a farm out here in the savannas was sold, the transfer would be recorded in your records?

Mr. COOKE. Yes, sir; in the zone records.

Mr. HUBBARD. Are there not Government lands in the zone which contain mineral deposits of value?

Mr. COOKE. None, so far as known at present.

Mr. HUBBARD. Are there any indications?

Mr. COOKE. I can not answer that question—I have heard very little of it. We have had one or two applications for lease of mineral rights, and I have answered that, in my opinion—and that opinion was approved by the then Governor Magoon—such applications would necessitate congressional action.

Mr. KNOWLAND. Do you think that the demand is sufficiently strong to justify some legislation on that line?

Mr. COOKE. I do not, at the present time.

Mr. RICHARDSON. You spoke of land for agricultural purposes; what is the character of that?

Mr. COOKE. They grow some vegetables, yams, yucca, sugar cane, and have some fruit trees.

Mr. RICHARDSON. Any corn?

Mr. COOKE. Some. There is probably in sight of the railroad, as you pass through, about 150 acres of corn.

Mr. RICHARDSON. How many people do you suppose, in the zone, are engaged in agriculture?

Mr. COOKE. Well, that is according to what you would consider agriculture. The average West Indian will rent a hectare of land, on which he will plant yams, yucca, a little patch of sugar cane, and possibly a little plat of corn as big as this room; maybe he will grow a pig and some chickens.

The CHAIRMAN. This soil is extremely fertile, is it not?

Mr. COOKE. I do not think so. I do not think this soil is very fertile.

The CHAIRMAN. About what is the length of a stalk of sugar cane grown here?

Mr. COOKE. About 6 or 7 feet. I have never run across a stalk 12 feet long. In Cuba and Porto Rico it grows to be as large as your wrist.

Mr. HUBBARD. What is the size of an ear of corn?

Mr. COOKE. It is a very small ear—they grow a very hard corn. Some of it is of better grade. We had some seed sent down by the Government, and gave each leaseholder some new seed; it has been fairly successful.

Mr. KNOWLAND. You do not think the agricultural possibilities of the zone are great enough to warrant the Government in sending an expert from the department down here?

Mr. COOKE. Well, to express an opinion on that would be to criticise the Government.

Mr. ESCH. All bars are down——

Mr. COOKE. I do not see the necessity for it.

Mr. HUBBARD. Might it not be of value to make an investigation of plants found here that are not found elsewhere? Has there been any such investigation?

Mr. COOKE. I know of none.

The CHAIRMAN. There is no agricultural experiment station here?

Mr. COOKE. Not here; no, sir.

Mr. KNOWLAND. Are there any valuable timbers in the zone?

Mr. COOKE. Very little. We had that question investigated some time ago. The investigation was brought about by a complaint that much valuable timber was being ruthlessly destroyed by settlers. The investigating party was mounted and out for several days, and based on their report I think it a very fair answer that there is very little valuable timber in the Canal Zone?

The CHAIRMAN. Any mahogany?

Mr. COOKE. Traces; most of it was cut off years and years ago.

The CHAIRMAN. What is the character of the wood out of which the hard-wood ties of the Panama Railroad were cut?

Mr. COOKE. A great deal of it is mahogany; some of it is *lignum-vitæ*.

Mr. ESCH. In the United States we have a regular survey system, with which you are familiar. In laying off a hectare of land, or receiving an application, what is the method of surveying—what is the method of marking so as to identify the lines?

Mr. COOKE. A description from some prominent object or the bank of a stream.

Mr. ESCH. Metes and bounds?

Mr. COOKE. Yes, sir.

Mr. ESCH. Are most of these tracts rectangular in form?

Mr. COOKE. No, sir.

Mr. ESCH. You have to lay out the land according to its natural features, streams, etc.?

Mr. COOKE. Yes, sir. In my opinion the best plan would be to have a survey of all lands available for lease, and divide the same into irregular tracts keeping in the office what is known as an irregular tract record, the record to show the actual survey boundaries. Leases could be made for all or portion of an irregular tract, No. 1, 9, or 20, as the case might be, or for as many irregular tracts as the lessee might desire.

Mr. RICHARDSON. Have you a public surveyor?

Mr. COOKE. There are any number of surveyors here that belong to the commission, of course.

Mr. BARTLETT. I have here a statement in the Canal Record in reference to land owned by the commission and others. It is on page 146 of bound Volume I of the Canal Record. I will read it:

OWNERSHIP OF ZONE LAND.

A committee composed of J. G. Holcombe, division engineer; George L. Campen, superintendent of public works; Tom M. Cooke, collector of revenues; and R. Yung, land agent of the Panama Railroad, was recently appointed to investigate and report on steps which should be taken in order to encourage leasing and cultivation of public and in the Canal Zone. The ownership of land in the Canal Zone is as follows:

	Square miles.
Owned by the United States by purchase from the New Panama Canal Company.....	52. 11
Owned by the United States by condemnation and purchase since the provisional delimitation of the Zone.....	3. 01
Public land held by the United States by cession from Panama under the treaty.....	188. 91
Owned by the Panama Railroad by cession from Colombia and purchase from private owners.....	68. 12
Owned by private persons.....	136. 22
Total.....	488. 37

Lands acquired by the United States by purchase from the Panama Canal Company are public property of the United States. Authority to lease such lands is derived from the act of Congress, approved July 28, 1892, authorizing the Secretary of War to lease, in certain cases, property for a period not exceeding five years, lease to be revocable at any time.

Mr. BARTLETT. Is that correct?

Mr. COOKE. Yes, sir. I believe I wrote that myself.

Mr. BARTLETT. That second item of 3.01 square miles does not include the land acquired by the last commission—Messrs. Denby and Bumpus—that was here?

Mr. COOKE. No, sir.

(Mr. Cooke here advised the committee that on page 179 of the bound Canal Record was an article containing suggestions relative to needed regulations in the matter of leasing of public land; that this report of his had been carefully drawn up and the subject-matter given every possible consideration, and that he would furnish a copy to the committee. Copy appended hereto.)

JANUARY 28, 1908.

SIR: Referring to your verbal request for statement as to the conditions existing in regard to the leasing of public lands on the Canal Zone, together with request that I make such suggestions as I believe would tend to encourage the settlement and cultivation of the land in the Canal Zone, I have the honor to submit the following:

PUBLIC LANDS IN THE CANAL ZONE.

Under the provisional delimitation of the Canal Zone, the area of the Zone is approximately 448.37 square miles, divided as to ownership as follows:

	Square miles.
Owned by the United States by purchase from the New Panama Canal Company.....	52. 11
Owned by the United States by condemnation and purchase since the provisional delimitation of the Zone.....	3. 01
Public land held by the United States by cession from Panama under the treaty.....	188. 91
Owned by the Panama Railroad by cession from Colombia and purchased from private owners.....	68. 12
Owned by private persons.....	136. 22
Total.....	448. 37

On May 9, 1904, by letter addressed to the Secretary of War, the President appointed Gen. George W. Davis governor of the Canal Zone, and directed that General Davis should, as governor, maintain possession of the Zone, including the public lands therein and the property on the Isthmus acquired from the Republic of Panama.

On September 2, 1904, the commission provided by resolution that all real property owned by the United States or under the control of the Isthmian Canal Commission on the Isthmus should be placed in charge and under the management and control of General Davis, as governor of the Canal Zone, who was authorized to lease lands. The governor by order turned the land department of the Zone over to the collector of revenues in January, 1905.

When the property of the French Canal Company was transferred to the Canal Commission a part of the land purchased from the canal company was under lease. The question of continuing the leases on these lands was referred to the Secretary of War, who directed that the leases should be continued, under the act of Congress of July 28, 1892, authorizing the Secretary of War to lease "for a period not exceeding five years, and revocable at any time, such property of the United States under his control as may not for the time be required for public use and for the leasing of which there is no authority under existing law."

Subsequently the question of leasing land in the Canal Zone, acquired from the Republic of Panama, which was public land of Panama before the exchange of the canal treaty between Panama and the United States, was referred to the Secretary of War, and he directed that such land should be leased upon the same terms and conditions and in the same manner as the land purchased from the New Panama Canal Company was leased.

The rate charged by the French Canal Company for agricultural lands was equivalent to \$6 United States currency per hectare per annum. Effective January 1, 1906, under authority of the Secretary of War, this rate was reduced by the governor of the Canal Zone to \$3 United States currency per hectare per annum. The rates charged for building lots in towns vary from 5 to 30 cents United States currency per square meter per annum.

At the time of the transfer of the zone the municipalities of Empire and Gorgona claimed certain public lands in the vicinity of those towns as "municipal lands." The lands claimed by them are included in the "public lands" referred to above. In an action between the Panama Railroad Company and Santiago Samudio, involving the title to lands at Empire, the circuit court for the second judicial circuit of the Canal Zone decided that the land claimed by the municipality was the property of the railroad.

The land claimed by the municipality of Gorgona was, up to the time when the municipalities of the zone were abolished, April 15, 1907, leased by municipal officials under a municipal ordinance. Since that time the leases on that land, as they have expired or have been canceled, have been rewritten by the collector of revenues on the same form as the leases for public land approved by the Secretary of War.

There are at present, June 30, 1908, 1,081 leases for public lands in the Canal Zone, executed by the collector of revenues on the form approved by the Secretary of War. One hundred and ninety-four of those leases are for agricultural lands, aggregating in area 590 hectares, and 878 are for town lots.

While efforts have been made to secure lessees and settlers of public lands, these efforts have not been systematic or general. There have been several obstacles in the way of systematic efforts along those lines:

First. There is a great deal of uncertainty respecting land titles in the Canal Zone; some of the land claimed as public land is also claimed by private persons, and some of the land claimed by private persons, it will probably be found upon judicial examination of the title, actually belongs to the Government and not to the claimants.

Second. There has been in the past, and still is, uncertainty respecting the land that will be required for canal purposes. It has been impossible to invite settlers to accessible and desirable land with any assurance that they would not be disturbed on account of canal work.

Third. It has been impossible because of the conditions of canal work, and also because of the provision of the law under which the land is leased, to lease land with any definite tenure or with any assurance that occupants would be reimbursed for the value of their improvements if the leases should be canceled.

Fourth. It is not believed that the rents charged for agricultural lands have deterred prospective settlers from leasing such lands, but it is possible that with the precarious tenure under which it is at present leased there might be more demand for it if the rate were reduced.

Fifth. The difficulty of transportation of supplies over the few and poor roads and trails of the Isthmus makes it difficult for any persons, except the natives with their pack horses, to transport agricultural products from farms to the nearest market.

Sixth. It is not to be expected that the agricultural lands of the zone will be developed by citizens of the United States or natives of the colder parts of Europe who may come here dependent upon their own efforts. Such persons can not successfully perform manual labor in this climate. The agricultural development of the Isthmus must be through the efforts of Americans, or others, with capital, who will employ the labor of the Isthmus, or of the West Indies, or through the efforts of natives of the Isthmus, the West Indies, or southern Europe, who can perform manual labor here themselves. Up to this time, so far as is known, but one definite application has been received for the rental of large tracts of land, and that application was not pressed when the applicant was notified that a lease with permanent tenure could not be given him.

It is believed that in an effort to encourage agricultural development in the zone the following measures should be taken:

1. Efforts should be made to determine as early as possible the lands in the Canal Zone that will be required for canal purposes; the limits of the lakes to be created by the construction of dams, and the ground that will be covered by dumps can doubtless be ascertained in large part, if not entirely, at this time.

2. The public lands of the zone should, where there is any question as to their character, be definitely determined by judicial action to be public lands. This could be accomplished by proceeding under the provisions of chapter 10 of the civil code in force in the Canal Zone under the President's order of March 22, 1907, prescribing a method of establishing titles to real property in the zone.

3. A survey of the public land of the zone should be undertaken and completed as early as practicable, the land to be divided into lots or sections of uniform size.

4. The regulations governing the leasing of public lands should be so amended as to authorize the commission to grant perpetual or long-time leases; and to provide, in the event that land should be required at any time for public purposes after having been leased in perpetuity or for a long period of time, for the reimbursement of the lessee of the value of his improvements upon the land. The revenues arising from the leasing of lands are covered into the zone treasury and the commission should be authorized to use such part of them as may be necessary for the purpose of reimbursement of such occupants of public lands. As the Secretary of War has stated that the authority to lease public land in the zone is derived from the act of Congress referred to above, it may be that to change the form of lease congressional action would be required. It is also possible that a distinction may be made between the two classes of public land in the zone, i. e., land purchased from the French Canal Company and that acquired from Panama under the treaty. To the former the United States has absolute title; to the latter it has the right of possession with all the rights of sovereignty in perpetuity.

5. Roads and trails should be constructed and improved as rapidly as possible. Main roads of substantial macadam construction should be built into the better agricultural parts of the zone, as far as the zone line, and from those roads cheaper roads and trails should be constructed. There is a considerable sum of money in the zone treasury available for public improvements in the zone, and a systematic definite plan for the construction of roads and trails should be adopted.

6. The commission should be authorized in opening public lands for settlement to reimburse squatters upon the land for the value of any improvements they may have put upon it unless such persons should exercise the right (which should be given them) to enter into a formal lease for such land.

7. The rate of rental should be decreased probably to \$1.50 per hectare per annum. It is believed that this amount would reimburse the government for any expense incurred, and nothing more than such reimbursement should be sought.

8. The authority for leasing the public land in the zone should be definitely fixed, as it is the opinion of the examiner of accounts, acting as auditor for the Canal Zone, that under the terms of the President's order, dated March 13, 1907, abolishing the municipalities of the zone, leases to public land in the zone should be executed by the local tax collectors instead of by the collector of revenues.

9. Pending the settlement of title to public lands in the Canal Zone and the survey of such lands the commission should be authorized to lease in perpetuity or for long times such lands as may be applied for, each application to be passed upon when received.

10. Efforts should be made to induce Spanish and Italian laborers to locate with their families in the zone, and when the commission is prepared to make secure the investment of capital in agricultural lands public notice should be given in the United States of that fact and of the advantages offered by agriculture in the zone.

Respectfully submitted.

TOM M. COOKE,
Collector of Revenues.

ACTING HEAD OF DEPARTMENT OF CIVIL ADMINISTRATION.

ZONE PUBLIC LANDS, AN OFFICIAL STATEMENT OF THEIR ORIGIN, EXTENT, AND CONDITIONS IN REGARD TO THEIR LEASING.

ANCON, CANAL ZONE, *January 28, 1908.*

Under the provisional delimitation of the Canal Zone, the area of the zone is approximately 448.47 square miles, divided as to ownership as follows:

	Square miles.
Owned by the United States by purchase from the New Panama Canal Company.....	52. 11
Owned by the United States by condemnation and purchase since the provisional delimitation of the zone.....	3. 01
Public land held by the United States by cession from Panama under the treaty.....	188. 91
Owned by the Panama Railroad by cession from Colombia and purchased from private owners.....	68. 12
Owned by private persons.....	136. 32
Total.....	448. 47

On May 9, 1904, by letter addressed to the Secretary of War, the President appointed Gen. George W. Davis governor of the Canal Zone, and directed that General Davis should, as governor, maintain possession of the zone, including the public lands therein, and the property on the Isthmus acquired from the Republic of Panama.

On September 2, 1904, the commission provided by resolution that all real property owned by the United States or under the control of the Isthmian Canal Commission on the Isthmus should be placed in charge and under the management and control of General Davis, as governor of the Canal Zone, who was authorized to lease lands. The governor, by order, turned the land department of the zone over to the collector of revenues in January, 1905.

When the property of the French Canal Company was transferred to the Canal Commission, a part of the land purchased from the canal company was under lease. The question of continuing the leases on these lands was referred to the Secretary of War, who directed that the leases should be continued under the act of Congress of July 28, 1892, authorizing the Secretary of War to lease "for a period not exceeding five years, and revocable at any time, such property of the United States under his control as may not for the time be required for public use, and for the leasing of which there is no authority under existing law."

Subsequently the question of leasing land in the Canal Zone acquired from the Republic of Panama, which was public land of Panama before the exchange of the canal treaty between Panama and the United States, was referred to the Secretary of War, and he directed that such land should be leased upon the same terms and conditions and in the same manner as the land purchased from the New Panama Canal Company was leased.

The rate charged by the French Canal Company for agricultural lands was equivalent to \$6 United States currency per hectare per annum. Effective January 1, 1906, under authority of the Secretary of War, this rate was reduced by the governor of the Canal Zone to \$3 United States currency per hectare per annum. The rates charged for building lots in towns vary from 5 cents to 30 cents United States currency per square meter per annum.

At the time of the transfer of the zone the municipalities of Empire and Gorgona claimed certain public lands in the vicinity of those towns as "municipal lands." The lands claimed by them are included in the "public lands" referred to above. In an action between the Panama Railroad Company and Santiago Samudio, involving the title to lands at Empire, the circuit court for the second judicial circuit of the Canal Zone decided that the land claimed by the municipality was the property of the railroad.

The land claimed by the municipality of Gorgona was, up to the time when the municipalities of the zone were abolished (April 15, 1907), leased by municipal officials under municipal ordinance. Since that time the leases on that land, as they have expired or have been canceled, have been rewritten by the collector of revenues on the same form as the leases for public land, approved by the Secretary of War.

There are at present 1,081 leases for public lands in the Canal Zone, executed by the collector of revenues on the form approved by the Secretary of War. One hundred and ninety-four of those leases are for agricultural lands, aggregating in area 570 hectares, and 887 are for town lots.

While efforts have been made to secure lessees and settlers of public lands, these efforts have not been systematic nor general. There have been several obstacles in the way of systematic efforts along those lines.

First. There is a great deal of uncertainty respecting land titles in the Canal Zone; some of the land claimed as public land is also claimed by private persons, and some of the land claimed by private persons it will probably be found upon judicial examination of the title to actually belong to the Government and not to the claimants.

Second. There has been in the past, and still is, uncertainty respecting the land that will be required for canal purposes. It has been impossible to invite settlers to accessible and desirable land with any assurance that they would not be disturbed on account of canal work.

Third. It has been impossible because of the conditions of canal work, and also because of the provision of the law under which the land is leased, to lease land with any definite tenure or with any assurance that occupants would be reimbursed for the value of their improvements if the leases should be canceled.

Fourth. It is not believed that the rents charged for agricultural lands have deterred prospective settlers from leasing such lands, but it is possible that with the precarious tenure under which it is at present leased there might be more demand for it if the rate were reduced.

Fifth. The difficulty of transportation of supplies over the few and poor roads and trails of the Isthmus makes it difficult for any persons except the natives with their pack horses to transport agricultural products from farms to the nearest market.

Sixth. It is not to be expected that the agricultural lands of the zone will be developed by citizens of the United States or natives of the colder parts of Europe who may come here dependent upon their own efforts; such persons can not successfully perform manual labor in this climate. The agricultural development of the Isthmus must be through the efforts of Americans, or others with capital, who will employ the labor of the Isthmus or of the West Indies, or through the efforts of natives of the Isthmus, the West Indies, or southern Europe, who can perform manual labor here themselves. Up to this time, so far as is known, but one definite application has been received for the rental of large tracts of land, and that application was not pressed when the applicant was notified that a lease with permanent tenure could not be given him.

It is believed that, in an effort to encourage agricultural development in the zone the following measures should be taken:

1. Efforts should be made to determine as early as possible the lands in the Canal Zone that will be required for canal purposes; the limits of the lakes to be created by the construction of dams, and the ground that will be covered by dumps can doubtless be ascertained in large part, if not entirely, at this time.

2. The public lands of the zone should, where there is any question as to their character, be definitely determined by judicial action to be public lands. This could be accomplished by proceeding under the provisions of chapter 10 of the civil code in force in the Canal Zone under the President's order of March 22, 1907, prescribing a method of establishing titles to real property in the zone.

3. A survey of the public lands of the zone should be undertaken and completed as early as practicable; the land to be divided into lots or sections of uniform size.

4. The regulations governing the leasing of public lands should be so amended as to authorize the commission to grant perpetual or long time leases, and to provide, in the event that land should be required at any time for public purposes after having been leased in perpetuity or for a long period of time, for the reimbursement of the lessee of the value of his improvements upon the land. The revenues arising from the leasing of lands are covered into the zone treasury, and the commission should be authorized to use such part of them as may be necessary for the purpose of reimbursement of such occupants of public lands. As the Secretary of War has stated that the authority to lease public land in the zone is derived from the act of Congress referred to above, it may be that to change the form of lease congressional action would be required. It is also possible that a distinction may be made between the two classes of public land in the zone; i. e., land purchased from the French Canal Company and that acquired from Panama under the treaty. To the former the United States has absolute title; to the latter it has the right of possession with all the rights of sovereignty in perpetuity.

5. Roads and trails should be constructed and improved as rapidly as possible. Main roads of substantial construction should be built into the better agricultural parts of the zone, and from those roads, side roads and trails should be constructed. There is a considerable sum of money in the zone treasury available for public improvements in the zone and a systematic, definite plan for the construction of roads and trails should be adopted.

6. The commission should be authorized in opening public lands for settlement to reimburse squatters upon the land for the value of any improvements they may have put upon it, unless such persons should exercise the right (which should be given them) to enter into a formal lease for such land.

7. The rate of rental should be decreased, probably to \$1.50 per hectare per annum. It is believed that this amount would reimburse the Government for any expense incurred, and nothing more than such reimbursement should be sought.

8. The authority for leasing the public land in the zone should be definitely fixed, as it is the opinion of the examiner of accounts, acting as auditor for the Canal Zone, that under the terms of the President's order, dated March 13, 1907, abolishing the municipalities of the zone, leases to public land in the zone should be executed by the local tax collectors instead of by the collector of revenues.

9. Pending the settlement of title to public lands in the Canal Zone and the survey of such lands, the commission should be authorized to lease in perpetuity, or for long time, such lands as may be applied for, each application to be passed upon when received.

10. Efforts should be made to induce American and European laborers to locate with their families in the zone, and when the commission is prepared to make secure the investment of capital in agricultural lands, public notice should be given in the United States of that fact, and of the advantages offered by agriculture in the zone.

STATEMENT OF MAJ. EUGENE T. WILSON, U. S. ARMY.

Mr. ESCH. What is your name and office?

Major WILSON. Maj. Eugene T. Wilson, major in the Coast Artillery of the United States Army, now subsistence officer of the Isthmian Canal Commission, also operating the commissary department of the Panama Railroad.

Mr. ESCH. Then, Major, you are a monument of the efficiency of your department?

Major WILSON. Better say advertisement.

Mr. ESCH. As such, what are your duties?

Major WILSON. I am in charge of the preparation and serving of meals in the various Isthmian Canal Commission hotels, where most of the white Americans live; in what we call European laborers' messes, composed mostly of Spaniards and Italians; and in the colored laborers' kitchens—that is, in the subsistence department. In the commissary department we provide all food supplies for everybody on the Isthmus; we sell them to the largest customers, viz, the subsistence department of the Canal Commission, to the sanitary department, to the hospitals, to the various dredges operated by the department of construction and engineering, and we also sell in the commissaries scattered along the line articles of food and clothing, a limited supply of household goods, kitchen utensils, etc., to the families of employees, both white and colored. We supply approximately 40,000 people.

Mr. ESCH. Where do you purchase your subsistence and commissary supplies?

Major WILSON. About 80 per cent in the United States.

Mr. ESCH. What supplies are not purchased there?

Major WILSON. We bought in the United States in the last six months \$1,388,000 worth and about \$209,000 worth from the local merchants here in Panama, and imported about \$105,000 worth of stuff from Europe.

Mr. ESCH. What did you import?

Major WILSON. Sauces (practically all Worcestershire sauce) and Yorkshire relish, which is used by the barrel.

Mr. ESCH. Any other kind of liquid?

Major WILSON. I will tell you later on. We bought from London some jams; most of it is a cheap jam made in London, which we sell for use in the colored laborers' kitchens. The colored laborer is very fond of jam, and it is a part of his ration. We are now experimenting with jams from California to take the place of these. We have 50 or 60 cases on hand, and if it goes off well, then we will get it from California. We have pickles, mineral waters, waterproof coats for men and women, tea and fruit salts—Enos—a good many people think it is good for prickly heat; we sell lots of it. Vinegar, gelatin, sardines, and cutlery. We also sell flannel—Welsh flannel—which is sold almost exclusively to the negroes. Some of these negroes come from Jamaica, Trinidad, and Barbados, but the large percentage of them come from Jamaica. They almost all wear flannel underclothing, as they are subject to consumption and pneumonia. We sell the flannel to them, and they make up the goods. We also sell kit bags; of these we have 172; also cigars and cigarettes, and cases of military brushes, etc.

Mr. ESCH. What is the total amount of your imports?

Major WILSON. \$105,926.40, and from the States, \$1,388,541.17.

Mr. ESCH. That is for how long a period?

Major WILSON. Six months. From Panamanian merchants we bought goods to the value of \$209,439.52.

Mr. ESCH. What are the chief items you purchased from them?

Major WILSON. We had some local contracts for cigars and tobacco; that is the largest item. These come from Jamaica and Habana, and also cigarettes. We buy cheap Rangoon rice, laid down here at \$2.57½ per hundred pounds, for the colored people. We also make local purchases of about 2½ tons of fish per week here. The lettuce and tomatoes you had to-night for supper were also bought down here, and there are other odds and ends. The commissaries buy everything in that line here.

Mr. ESCH. That shows your purchases?

Major WILSON. Yes, sir.

Mr. ESCH. Will you state to the committee, how you ration or feed the different races employed by the Commission?

Major WILSON. In the first place we try to feed the white men in the hotels, such as those you had lunch in at Culebra and Gatun, on about the standard they are used to in the United States. We get 30 cents per meal for that meal.

Mr. ESCH. Gold?

Major WILSON. Yes, sir. We feed the Spaniards on a food-cost basis. I give the various stewards a limit food cost of 34 cents for food per day—that is, gold—and they are not allowed to run over that. We allow 1½ pounds of fore-quarter and 1½ pounds of hind-quarter per ration, and that is the limit. Then we have to import a lot of stuffs for them—namely, garbanzos, conserva de pomodoro, chorizos, and various other Spanish delicacies. The negro laborer feeds on a ration; he is allowed so much—1 pound of meat, 1 pound of bread, one-sixth pound of flour, 1 pound vegetables, one-half pound rice, four-tenths pound sugar, etc., per day. His total ration, everything included, weighs about 4.3 pounds, and our army ration is 3.84 pounds, so he gets a reasonable amount of food.

Mr. ESCH. What is the weight of the ration you give the white laborer?

Major WILSON. There is no weight at all; it is left largely to the steward, but he can not go above a certain food cost. In large hotels where we feed many people, the food cost is put down a little lower—1 cent or 2 cents—than in the others, because he can feed it so much cheaper.

Mr. HUBBARD. About how much is the daily cost of a ration to the negro?

Major WILSON. About 28 or 29 cents, it depends upon prices.

Mr. ESCH. And that is deducted from his wages?

Major WILSON. Yes.

Mr. ESCH. In advance?

Major WILSON. No, sir; when a negro or Spaniard wants to eat the next day at the mess or kitchen, before he knocks off work he goes to the timekeeper and asks for a meal ticket, and the timekeeper issues him that ticket, which he presents at any mess or kitchen along the line. We take up the meal ticket and give him supper and an exchange check, which entitles him to his breakfast and dinner at that particular mess or kitchen the next day. When the timekeeper issues him the meal check, he has then got a day's work in to pay for it, and he makes a deduction on his pay roll to pay for that ration when he issues that check. We do not handle any money at all except for a few casual people who have no meal tickets and drop into the hotels.

Mr. ESCH. These people of different races require different foods. Do you pander to that taste?

Major WILSON. Oh, yes, indeed. The Spaniard requires the things he is accustomed to in his own country and will have them as he wants them. The negro we feed according to the way he eats back in his own country. I fixed up and changed the rations a little since I came here. I took about one dozen kitchens where the men had been very successful in feeding the negro and took an average result and made up a ration that I thought would work out all right. I put this into effect at two or three places and tried it for four or five weeks, and it is very satisfactory. It is a little more suited to their national taste, and if there is a new cook, and he will keep to the ration laid down, he will not make a botch of it.

Mr. ESCH. Have you any system for hearing complaints with reference to the food?

Major WILSON. We have no particular system about it. I get over the line a good deal and I have three men on the line all the time. The men down here are not at all backward about writing a letter about the food, and if anything goes wrong I know about it quickly.

Mr. ESCH. At the present time is there satisfaction as to the food furnished?

Major WILSON. Yes, sir.

Mr. ESCH. And the condition of the men justifies that opinion?

Major WILSON. I think so; they look to me to be a happy, healthy, and contented lot of men. Occasionally things go bad; but in that case you have to get out and hustle and straighten it out.

Mr. KNOWLAND. Is the matter of the selection of cooks under your jurisdiction?

Major WILSON. Yes, sir. The employment of the labor in the commissaries, hotels, etc., is under my jurisdiction.

Mr. KNOWLAND. How many different cooks do you suppose you have at the hotels and places where you feed the men?

Major WILSON. About 71 or 72.

Mr. KNOWLAND. And how many different places are there here in the zone where you feed these men?

Major WILSON. About 70.

Mr. HUBBARD. You speak of hotels and kitchens; what do you mean by that?

Major WILSON. We call a hotel where the white Americans eat an Isthmian Canal Commission hotel; such as at Culebra, where you were, and at Gatun. These hotels are on our books as official Isthmian Canal Commission hotels. As for the mess, I do not know how that name started, but the place where the Spaniards and European laborers eat are known as "messes," and the kitchen is a separate institution; these are known as "colored laborers' kitchens."

Mr. BARTLETT. Did we get about the same dinner yesterday as you furnish on an average?

Major WILSON. Yes, I think so; in fact, the steward at Gatun told me that they usually feed a little better than that, except that he had good pie.

Mr. ESCH. Does the steward inspect the cooking, kitchens, and service?

Major WILSON. Yes, sir. They see that they keep them clean.

Mr. ESCH. Do these three men you have out on the line inspect the service?

Major WILSON. Yes, sir. They inspect everything.

Mr. ESCH. Is there any inspection of food?

Major WILSON. Yes, sir; inspection is made by everybody who handles it before it leaves the warehouse.

Mr. ESCH. You buy it by sample?

Major WILSON. The original inspection starts in New York. It is bought in New York and inspected there. When it comes down here, we handle it and look it over and see if it is all right as it is unloaded, then when it gets out along the line and goes to the different hotels, everybody in my department has orders not to serve food unfit for human consumption to anybody, and if there is any suspicion of the food, the steward calls in a sanitary inspector at once, and if he says it is not fit, it is dumped overboard.

Mr. ESCH. In other words, you apply on the zone the pure-food act?

Major WILSON. Absolutely. I have told everybody that if I catch them serving or selling food not fit for consumption, I will fire them.

Mr. ESCH. How about the inspection of the stuffs you buy from abroad—is there any inspection of that?

Major WILSON. No, sir; only when it arrives here.

Mr. ESCH. How do these foods comply with our pure-food act?

Major WILSON. So far as I know I think they are all right. When I suspect anything that looks bad, I send it to the chemist; but I have not struck anything yet.

Mr. ESCH. Where do you buy your flour?

Major WILSON. In New York. Most of it comes from Minneapolis, from the Washburn-Crosby and the Pillsbury people. We also get some from California.

Mr. ESCH. How does that flour stand the climate?

Major WILSON. It deteriorates very rapidly on account of its rapid absorption of moisture and its tendency to mold.

Mr. ESCH. Is there any precaution you can take against it?

Major WILSON. Only to get rid of it as quickly as possible. The best protection is to carry only a few days' stock. We generally have a stock for ten days, and every six days we have a delivery. Macaroni we buy in New York and New Orleans, and some samples from abroad.

Mr. ESCH. How do they compare with the home product?

Major WILSON. Very much superior in flavor and keeping qualities.

Mr. ESCH. But how as to price?

Major WILSON. About a shade higher in price.

Mr. ESCH. Freight added?

Major WILSON. Yes, sir. We pay for macaroni in the States 4 cents per pound in 1-pound cartons, and \$5.44 per 100 pounds in 50-pound tin-lined boxes. For foreign macaroni we pay 56 francs per 100 kilos, f. o. b. Southampton. That would stand us about 5 cents per pound here.

Mr. ESCH. Can vegetables be grown here?

Major WILSON. Not to speak of.

Mr. ESCH. Have you not an experimental garden?

Major WILSON. Yes; but not on the scale required. We have sweet potatoes which do fairly well, but Barbados is the principal source of our supply. We have to get them very cheap, as they form a large part of the colored men's rations. The negroes are very fond of yams and sweet potatoes, and it keeps us hustling to supply them.

Mr. ESCH. Put in more yams.

Major WILSON. Well, they cost more than sweet potatoes. We get our supply from the West Indies. We run in about two weeks' supply from Jamaica of yams, and two weeks' from Barbados the other way, and if we run short we supplement these with Irish potatoes from the States. But to get back to the experimental garden. I will say string beans do very well here, parsley does fairly well, and the eggplant does exceedingly well, though they are a little small. Tomatoes do very well, although they do not get very large. We had tomato salad to-night, and those tomatoes were grown in the local gardens. All the rest of the plants go to top and seed. Plants like lettuce and celery get bitter, and the cost of raising stuff is made more by insects and other pests. As a whole, we only handle it for little garnishments or seasonings; we handle it more extensively when the northern ports are closed.

Mr. ESCH. From a sanitary and health standpoint, do you control the food of the men, or do you allow them to buy outside of their meals?

Major WILSON. In the commissaries?

Mr. ESCH. Or anywhere else.

Major WILSON. We do not control purchases in the local commissaries at all. For instance, if I or any other man employed on the Isthmus wants to buy food for his family he can buy what he pleases.

Mr. ESCH. Can a negro do that?

Major WILSON. Oh, yes.

Mr. ESCH. Do you commute rations in any way?

Major WILSON. No; eating in the mess is purely a matter of volition on the part of the negro; one day he says, "To-morrow I want to eat in the mess," and the next night he need not get a ticket unless he wants to.

The CHAIRMAN. Can he go to the commissary and buy?

Major WILSON. Yes; for every \$13 worth of stuff, \$7 is sold to the white people on the gold side and \$6 on the silver side. We carry a

large line of goods for the negro, and the truth is, he is a very much more discriminating purchaser than his white brother. He buys the very best and wants it.

Mr. HUBBARD. The \$6 does not include rations; it is the voluntary purchases?

Major WILSON. Yes, sir.

Mr. HUBBARD. Where do you buy clothing, boots, and shoes?

Major WILSON. All boots and shoes are bought in the United States; most of them in Brockton and in Lynn, and a few of them in New Orleans and in St. Louis, but most of them come from Massachusetts.

Mr. HUBBARD. And clothing?

Major WILSON. We only have a small line of ready-made clothing, made by Hart, Schaffner & Marx, of Chicago. Most of the clothing sold here is ordinary linen cloth; that is, we buy the goods and it is made up here. Cotton goods all come from the United States, and the linen from Belfast.

Mr. ESCH. Will you please state who has the right to buy at the commissary stores?

Major WILSON. Under the regulations all employees of the commission and of the Panama Railroad; and the American minister, through the request of the State Department and the approval of the Panama Government; and the British minister, also through the British foreign office; and the Peruvian minister; and one or two chaplains and itinerant preachers, to whom we sell commissary books for cash.

Mr. ESCH. And the identification is the book?

Major WILSON. Yes; and the metal check for employees. The ministers have charge accounts. It is charged to them, and they pay the bill, as they would the grocer at home.

Mr. ESCH. Is there any possibility of deception and the loaning of a check or commissary book to an outsider?

Major WILSON. Yes, sir.

Mr. ESCH. Is it in practice?

Major WILSON. I think it is practiced very little.

Mr. ESCH. Is there any tendency for the Panamanians to get in on that?

Major WILSON. Oh, yes; they like to get in, but I corral them and take up the book and confiscate the check. If a man has not his check he is in a bad way, as he can not get his pay.

Mr. HUBBARD. Is that an offense against the regulations?

Major WILSON. Yes, sir.

Mr. HUBBARD. Punishable as a misdemeanor?

Major WILSON. No; it is a violation, but it is not punishable. The punishment is that if he has a \$15 book and I take it up, he is out \$15. I catch them at Cristobal two or three times a week. If we got a little more assistance from the Panamanians we would break it up entirely.

Mr. HUBBARD. In your opinion, it is absolutely necessary for our Government to maintain these commissary stores.

Major WILSON. Absolutely. Because it is absolutely necessary for the United States Government to maintain down here a healthy, contented, energetic, and well-nourished body of employees to furnish the brains and directive force for the canal, living about as they do in the States, and it is absolutely essential to the carrying on of the work that our hands, the negroes especially, should be well

nourished and provided for, in order that the United States may get a return for the money it pays them.

Mr. ESCH. And you believe that that opinion is shared by practically all the employees on the zone?

Major WILSON. I know it is. I have had hundreds of men say to me that if the commissary privileges were discontinued they would not stay here two weeks.

Mr. ESCH. The object of the Panama merchants to abolish the stores is to secure that share of the trade?

Major WILSON. Yes; and particularly the negro trade, because he is helpless. Because they can carry him and give him credit and charge him high prices, thus getting rich quickly. There is not a people on the face of the earth that has a large negro population among them that does not have to look after them.

Mr. ESCH. In operating these hotels, so called, are they run at a profit or a loss?

Major WILSON. Including this hotel here?

Mr. ESCH. First take up the hotel here.

Major WILSON. In the rainy season, which is the summer season in the States, there is not much patronage at this hotel, and it is run at a loss, but in the winter season it makes a little money. The last fiscal year it made \$236; this year it has made money three months and lost three months. On the 1st of January the estimated loss for six months was \$391; that was last week, and I will pull that out this month all right.

Mr. ESCH. Yes; we are here. Go on with the others.

Major WILSON. The Isthmian Canal Commission hotels in the summer months run along either breaking even or making a little money, so that when butter and eggs get high in the States they will not be pinched, but will have a uniform diet. They will lose about \$1,000 this month, and at the end of the fiscal year they will break even. The Spaniards on their 40 cents per day break even. The kitchens do a little better than that, and I am lengthening out their ration, so that whatever they have saved on my books they will get their share of at the end of the year.

Mr. ESCH. To run this hotel, then, you are obliged to charge higher rates at the other hotels?

Major WILSON. Not at all; this tub stands on its own bottom.

Mr. ESCH. I asked that for a purpose. I have heard some employees on the road say that they had heard that the hotels made \$7,000 per year profit, and that the profit was to make good the losses in this hotel.

Major WILSON. Oh, no.

Mr. ESCH. So this hotel is absolutely distinct?

Major WILSON. Absolutely. The \$7,000 would last me just five days in the Isthmian Canal Commission hotels.

Mr. ESCH. How do the other hotels run?

Major WILSON. So as to break even at the end of the fiscal year. Everything is closed up on the June books, and I do this, as I said, so that in the summer months, when fruit and vegetables are low, I get a little money, and in the winter, when butter and eggs are high, I have a little nest egg saved up, so that I do not feel like pinching them on the food. My desire is to serve uniform food throughout the year, and I have to look a little ahead and forecast, so as to see

what prices are likely to be in the future in the States. I know the cost of the meals to the one one-hundredth of a cent.

Mr. KNOWLAND. How much higher are the prices in the commissary than in the United States?

Major WILSON. It depends upon where you are.

Mr. RICHARDSON. Well, say beef.

Major WILSON. For roast beef we charge 22 cents here, and we trim it a lot closer than anywhere in the East, and any steak excepting porterhouse has the bone cut out of it. In the States the butcher sells the bone with the meat, but we cut the bone out here, and when we get half a ton or so we send it out to the Spanish messes to thicken up the soup, selling it at $1\frac{1}{2}$ cents per pound. I should say the beef prices here are the same as in the cities of New York, Washington, Atlanta, Columbus, Ohio, and Indianapolis, etc.

Mr. RICHARDSON. On an average, are the prices charged at the commissary stores on the zone higher than those in the States, by the cost of transportation?

Major WILSON. The retail prices in the States?

Mr. ESCH. Yes.

Major WILSON. No, sir; on staple groceries we are a little less than in the States. I compared my prices with the prices of Park & Tilford, as given in their quarterly price list, and mine are a little less than theirs, excepting one item in staple groceries.

Mr. HUBBARD. Are there sudden changes in prices on any of your articles; beef, for example?

Major WILSON. It is a half cent up since the election.

Mr. HUBBARD. No change greater than that in your retail prices?

Major WILSON. I do not think I have made any change in the price of beef for two or three months.

Mr. HUBBARD. What variation has there been in the price of beef during the last year?

Major WILSON. I have only been here six months.

Mr. HUBBARD. What variation has there been in the price of beef during the last month?

Major WILSON. On December 29 I sold mutton suet at 6 cents; shoulder and neck at 7 cents; beef rib roast, short cut, 23 cents; rib second cut, 19 cents; that is on the 29th of December. The last price I have here in this book is the retail price on the 18th of October, which is the same price.

Mr. HUBBARD. There have been no changes since the 18th of October?

Major WILSON. No, sir; none at all in the retail price of beef.

Mr. RICHARDSON. Will you tell us how much you expended in transporting provisions and supplies between the United States and the Canal Zone in the last six months—which amount to over \$1,000,000? What freight did you pay on that? Have you not an account of the freight you paid the lines you shipped it over?

Major WILSON. No, sir; I have not got it here; but my ocean freight is approximately \$20,000 per month.

Mr. RICHARDSON. What lines do you ship over from New York here?

Major WILSON. The Panama Railroad Steamship Company, and the Royal Mail Steam Packet Company carries refrigerated goods, beef, etc.

Mr. RICHARDSON. What is the difference in the charges of freight on the Panama Steamship Line and the Panama Railroad when it strikes into Colon or Panama?

Major WILSON. You mean the difference in the freight rate? From New York to Colon the freight rate is \$4.70 per ton.

Mr. RICHARDSON. And from Colon to Panama?

Major WILSON. The commissary freight rate is \$2.35 per ton, but it is a postage-stamp rate. I pay \$2.35 to Gatun and \$2.35 to Panama, which is 42 miles.

Mr. RICHARDSON. What difference is there between the freight rates charged the Government and an ordinary consignee?

Major WILSON. Absolutely none, so far as I know.

Mr. RICHARDSON. The Government pays just the same for the transportation of its supplies?

Major WILSON. Yes, sir. I get no differentials or rebates. In fact, I get a little cheaper rate from New Orleans.

Mr. RICHARDSON. Is there any difference in freight charges from Colon to Panama as to the Government and as to the private citizen?

Major WILSON. Yes, sir.

Mr. RICHARDSON. What is it?

Major WILSON. I do not know what the local rates are. I am not very well informed as to that. I think they pay in or around \$5 or \$6 per ton on the freight, depending on the commodity. I pay a postage-stamp rate from one end of the Isthmus to the other.

Mr. RICHARDSON. Would that postage-stamp rate average you less than a distance rate?

Major WILSON. I can not say as to that.

Mr. RICHARDSON. Does not most of your freight come over here?

Major WILSON. No, sir.

Mr. RICHARDSON. What is your largest distributing point?

Major WILSON. The other side of Empire.

Mr. HUBBARD. Is that rate fixed so as to save money, or as a matter of convenience?

Major WILSON. It is a matter of convenience in accounting. I make up the waybills for the railway company. We would eat up all our profits if we had to put in an accounting force to take care of the rates.

Mr. HUBBARD. So it is charged as if the Panama Railroad were a distinct corporation?

Major WILSON. Absolutely, excepting on the postage-stamp rate; I pay them for everything I get.

Mr. KNOWLAND. What is the freight rate from San Francisco to Panama?

Major WILSON. I do not know; it is \$10 on the books, but I suspect about \$5.

Mr. KNOWLAND. You do not ship anything from there here? *

Major WILSON. I pay \$10 down here, but the people up there, I believe, pay \$5, the object being to throw them into competition with the people back East, and I think the rate of \$5 is given them to put everybody on the same basis on the Pacific coast. Those products on which they can compete are put on a basis of freight and insurance paid, and delivery on the dock at La Boca.

Mr. CUSHMAN. Freight is paid by them?

Major WILSON. Yes.

Mr. ESCH. What arrangements have you on the zone and on the boats for refrigeration?

Major WILSON. The Panama Railroad boats are equipped to a limited extent to carry meats and vegetables. The Royal Mail boats, which come here every two weeks, are equipped to carry frozen meats. Most of these vessels come out of the Rio Plata trade, where they were carrying frozen meats to Southampton. Their facilities for carrying bulk meats are ample. The New Orleans United Fruit Company carry vegetable refrigeration for bananas, and on the Pacific side there are no facilities at all.

Mr. ESCH. You have refrigeration facilities on the zone?

Major WILSON. Very fair, sir.

Mr. ESCH. There is no trouble about deterioration?

Major WILSON. There is not trouble about deterioration of meats in the boxes at all. With vegetables we have some trouble, as it is a pretty tough climate on Temperate Zone vegetables.

Mr. HUBBARD. Has there been any delay or complaint of delay in transferring from the ship refrigerator to the shore refrigerator?

Major WILSON. No, sir. The Royal Mail boats get out within twenty-four hours after they arrive, and we have to get the stuff out right away; if we do not, they go to sea.

Mr. RICHARDSON. Where do you get your cold-storage goods from?

Major WILSON. Most of our meat comes from New York; it is bought from Nelson Morris & Co. When it reaches New York it is transferred to the ship line, and when it reaches here it is transferred to me.

Mr. RICHARDSON. Have you had any complaints about cold storage?

Major WILSON. No, sir.

The CHAIRMAN. How quickly is that transfer made from the cold-storage car to the cold storage on the ship in New York?

Major WILSON. I cannot say. They haul it in a wagon very quickly. The meat is subject to inspection and rejection here.

The CHAIRMAN. How long is required after the cold-storage box is opened here before it is placed in the cold-storage plant here?

Major WILSON. We load it into the refrigerator car right out of the boxes.

The CHAIRMAN. That is done immediately?

Major WILSON. Yes, sir.

The CHAIRMAN. How long would it be from the time you commenced to load the car up until loading is completed and the car closed?

Major WILSON. We loaded out three cars of cold-storage stuff for the navy here about three weeks ago. We opened up the boxes, loaded the cars, and had them hiking across the Isthmus within two hours.

The CHAIRMAN. Is that usually done as quickly as that with your cold-storage meats?

Major WILSON. Yes, sir; and they will keep in the cars for eight or nine days frozen. When in the cars they are perfectly safe, as they are thoroughly iced.

Mr. HUBBARD. What percentage of that amount is condemned?

Major WILSON. I have not lost a single quarter of beef and but two veal in six months.

Mr. ESCH. To what extent do you purchase native beeves.

Major WILSON. I buy no native meat at all, excepting a few live chickens for the hospitals.

Mr. ESCH. What kind of beef do you buy from Nelson Morris & Co.?

Major WILSON. We have two grades; one of them is corn-fed and finished steers, dressing 800 pounds, according to navy specifications. The other is a lighter weight beef bought under the same specifications, except it is not required to be corn fed; but they are good medium steers from 600 to 650 pounds.

Mr. ESCH. These might be steers from the plains?

Major WILSON. Yes; they might be. Some of them are grass-fed range cattle. But the big cattle must be corn-fed native steers. It is a magnificent meat. You may go over to the plant and see it, if you wish to.

The CHAIRMAN. What do you pay for the first-quality meat?

Major WILSON. We buy our meat on a sliding scale. The highest price is for live cattle on the hoof, paid in Chicago, which is certified by the secretary of the National Live Stock Exchange, Chicago. We pay for our light-weight meat, hind quarters, 26 per cent over the live-stock price delivered in New York, and for fore quarters 22 per cent less. On the whole carcass, it figures out that we pay in New York for the lighter-weight meat the live-cattle price paid in Chicago. If it is 8 cents in Chicago we pay 8 cents for the whole carcass in New York.

The CHAIRMAN. Have you ever, in the last year, paid over 8 cents for cattle on the hoof in Chicago?

Major WILSON. Yes, sir; more than that. We paid \$8.40 last June.

The CHAIRMAN. What did you pay during November?

Major WILSON. \$7.50.

The CHAIRMAN. Do you pay that with the 26 per cent added for your light weights?

Major WILSON. For the hind quarters, yes; and 22 per cent off for the fore quarters. It brings it so that when beef is \$7.50 at Chicago—live cattle—we pay \$7.50 in New York for dressed cattle.

The CHAIRMAN. That is for second-quality meat?

Major WILSON. Yes; and when it is \$7.50 for live cattle, best meat, we pay 20 per cent added, which would make it 9 cents on the whole-carcass basis.

The CHAIRMAN. Do you mean that you pay 9 cents for the weight that you get?

Major WILSON. Yes, sir. If the carcass dresses 800 pounds, at 9 cents I would pay \$72 for that carcass.

Mr. ESCH. Now, you are the commissary and subsistence agent for the Panama Railroad, as well as for the Canal Zone, are you not?

Major WILSON. Yes, sir.

Mr. ESCH. Do you treat employees of the Panama Railroad just the same as the employees of the commission?

Major WILSON. Absolutely.

Mr. ESCH. Do they have messes and hotels, or do they go into private messes?

Major WILSON. They have one hotel, the Washington, at Colon, but everywhere else they go to the same mess. They only operate one hotel, and that is in Colon.

Mr. BARTLETT. Do you buy liquors or whisky?

Major WILSON. We buy Bordeaux wine for the Spanish laborers. We give them cheap claret or a cheap wine twice a week.

Mr. BARTLETT. Do you furnish any for the negroes?

Major WILSON. No, sir.

Mr. ESCH. Where do you buy your coffee?

Major WILSON. We buy Java and Mocha in New York, and Costa Rica and Central American coffees we buy here; Santos coffee we buy from New York.

Mr. ESCH. Do you buy any Porto Rican coffee?

Major WILSON. No, sir; not here.

Mr. BARTLETT. Do you buy tobacco of any sort?

Major WILSON. In the States we buy chewing, plug, and the ordinary brands, like Bull Durham, and other well-known brands of smoking tobacco, but the cigars and a good many cigarettes come from Habana and Jamaica.

Mr. BARTLETT. You mean to say you buy no liquors, whisky, or brandy, or sell them?

Major WILSON. No, sir; we are not in the liquor business, but I buy a little brandy and sherry for the Tivoli Hotel to cook with.

Mr. BARTLETT. Do you buy any for the employees generally?

Major WILSON. No, sir.

Mr. BARTLETT. When it becomes necessary for them to have it, where do they get it?

Major WILSON. You can not throw a stone on the Isthmus without hitting a beer bottle almost anywhere. If he is sick the doctor will give it to him; he can get it at the nearest hospital or dispensary.

Mr. ESCH. Do you buy medical supplies?

Major WILSON. No, sir; nothing but food and household goods.

Mr. CUSHMAN. Give us a general idea of the prices of clothing, standard articles, such as caps, boots, pants, and coats.

Major WILSON. We are furnishing ready-made white duck cotton suits at from \$5 to \$5.50. We sell Hart, Schaffner & Marx ready-made clothing at from \$12 to \$17; Belfast linen at from 25 cents to 80 cents per yard. We sell working shirts from 50 cents to whatever a man wants to pay, and overalls from 60 cents to 75 cents—about as in the States. We sell the Hanan shoe, which is sold at retail in the States for \$6, for \$5.50. The Manhattan shirt, which is sold for \$2 in the States, we sell at \$1.75, and that is about a fair proportion of the prices.

Mr. BARTLETT. How can you sell the Hanan shoe here for \$5.50 when it retails in the States for \$6?

Major WILSON. Because we do not want to make so large a margin of profit as they do. There is a very large margin of profit on any well-known or well-advertised article.

Mr. BARTLETT. But you do not sell them at a loss?

Major WILSON. No, sir.

Mr. BARTLETT. Do you make a profit on that?

Major WILSON. Yes; about 30 per cent.

Mr. KNOWLAND. I have heard some of the men state that everything they bought here was higher than at home. According to your statement of the price of clothing that is not a fact. How is it in regard to other lines?

Major WILSON. Well, a good many men have been here a long time, and they go back to the days when they were back home. But the cost of living has been running higher during the last year or two and a good many men make comparison with the prices of several years ago. A good many men come from the smaller places from where the best beef is exported. For instance, in central Ohio we export the beeves weighing 1,600 to 1,700 pounds, but we eat the little heifers. They compare corn-fed native steers with the prices of heifers and the fat cows they ate back there. I do not think our prices here are at all exorbitant. The refrigeration account every day in the year costs a whole lot of money.

Mr. KNOWLAND. Take New York as a point of comparison. How much higher is beef here than in New York?

Major WILSON. In the first place, it is pretty hard to answer, because the New York butcher never cuts the bone out of the meat, and we always do. My butcher's bill here is about the same as it was in New York, and I eat the same kind of things. There is very little demand for cheap meat. For family trade nobody will buy forequarters, except the ribs, and I do not bring any in, but you may note in my price list soup meat at 8 cents and stew meat at 12 cents per pound. All that comes from the hind quarter. Forequarter mutton sells at 9 cents and forequarter lamb at 9 cents.

The CHAIRMAN. Major, complaint is made that where prices apparently are low it is sold in such quantities that a family can not afford to buy it. What have you to say in regard to that? As, for instance, on ten or twenty pounds of roast is more than any family would choose to buy.

Major WILSON. Our limit on roasts is rib roast, second cut, not under 3 pounds; rib roast, short cut, not under 3½ pounds; that is about the weight of a good porterhouse steak; anything above that he can buy, but not less than 3½ pounds. Then, too, somebody comes along and wants to buy one-half pound of porterhouse steak—that is, butchering up and spoiling one of the five porterhouse steaks, as you know there are only five porterhouse steaks in a beef. There is no fixed rule in regard to things of that kind. Recently a man ordered a 1½-pound roast. He signed himself as a designer. We told him that if he would design a roast that would weigh 1½ pounds we would cut it for him.

The CHAIRMAN. Then it would be a steak?

Major WILSON. Yes, sir; and I figure out that a man of that kind wants a steak. Mutton got down low in October, and I thought I would drop the price of mutton chops. I put them low, and I could not sell anything but mutton chops. I had to get rid of hind quarters at 6 and 6½ cents. Chops were down to 20 cents.

The CHAIRMAN. Is it the purpose of your department to make money out of your sales or to keep even?

Major WILSON. To keep even.

Colonel GOETHALS. Right here, I would like to say that the Panama Railroad Company owns the commissary, and we are obliged to reimburse the Panama Railroad for expenditures for the commissary and laundry, so that makes a standing charge on everything brought to the Isthmus and sold to the commissary. Outside of that and the operating costs they are supposed to break even.

Major WILSON. Our object here is to keep our food cost down as low as possible and dig the canal. I do not make any money, but I can not lose any. When I say I need the money, I mean I can not lose any, and I give the very best service I can in order to keep people contented and happy, so that they will stay down here and dig the canal

(The committee thereupon adjourned until to-morrow, Thursday, January 7, 1909, at 9 o'clock a. m.)

HOTEL TIVOLI,

Ancon, Canal Zone, Thursday, January 7, 1909.

The committee met at 9 o'clock a. m.

Present: Messrs. Hepburn (chairman), Stevens, Esch, Cushman, Kennedy, Knowland, Hubbard, Richardson, and Bartlett.

Also present: Col. George W. Goethals, U. S. Army; Maj. C. A. Devol, U. S. Army; Mr. Joseph Bucklin Bishop, secretary of the commission, and others.

STATEMENT OF MR. JOSEPH BUCKLIN BISHOP.

Mr. STEVENS. What is your name and official position?

Mr. BISHOP. Joseph Bucklin Bishop, secretary of the commission.

Mr. STEVENS. How long have you been connected with the commission in that capacity?

Mr. BISHOP. Since September, 1905.

Mr. STEVENS. How long have you been upon the Isthmus?

Mr. BISHOP. I have been upon the Isthmus since August, 1907; before that I made visits to the Isthmus every few months.

Mr. STEVENS. What is the nature of your work in connection with your office?

Mr. BISHOP. Well, in addition to the secretary work, I also supervise the publication of the Canal Record, and I investigate complaints of employees under direction of the chairman.

Mr. STEVENS. In what way do these complaints come to you?

Mr. BISHOP. Usually in the form of a letter to the chairman, which is forwarded to me with directions to investigate.

Mr. STEVENS. That is to say, if any employee writes to the chairman making a complaint, the letter is turned over to you for investigation?

Mr. BISHOP. Yes.

Mr. STEVENS. In what way do complaints come, from individuals or from organizations?

Mr. BISHOP. From individuals entirely.

Mr. STEVENS. What is the general nature of complaints?

Mr. BISHOP. They cover a very wide field. Sometimes about the treatment in the mess rooms; sometimes about the quality of the food; sometimes troubles with heads of departments. Nearly all branches of the work are covered, including laborers and nurses. I submit a list of complaints, with their disposition, that have come before me. (See appendix, No. 152.)

Mr. STEVENS. Are you in close touch on account of the duties in your office with the various classes of employees on the Isthmus?

Mr. BISHOP. Yes. A great many of them come in and make complaints, and after I have talked freely with them they often abandon them. I am sure no complaints have been made about my decisions.

Mr. STEVENS. In your dealings with employees what have you noticed concerning the loyalty and the interest of the employees in the general scope and nature of the work?

Mr. BISHOP. In answer to that I will go back to the situation when I came down here. There was then waiting a large number of complaints that had not been investigated, and during the first six months I gave up a large part of my time to investigate these complaints, but within the last six months or more there has been scarcely a complaint. I have had five or six during that period, and my inference from this is that there is a great deal more contentment now than there was when I first came down here. During the last six months there has been an almost complete absence of anything like serious dissatisfaction.

Mr. STEVENS. What interest do the employees manifest in the success of the work?

Mr. BISHOP. Very great, always.

Mr. STEVENS. Do you find any enthusiasm in the work?

Mr. BISHOP. Yes, generally.

Mr. STEVENS. What do you know about the loyalty of the employees in general to the project and to their officials?

Mr. BISHOP. It is practically unanimous.

Mr. STEVENS. In what way?

Mr. BISHOP. The complaints are generally from people who would make complaints anywhere. They are trouble makers; we have them in the United States, and they are almost always repudiated by their own witnesses.

Mr. STEVENS. So that we can depend that the great mass of the employees of the commission are enthusiastic in their work and loyal to the project and to the chief in charge of the work?

Mr. BISHOP. That is the situation exactly.

Mr. STEVENS. Have any complaints come to you, or to your knowledge, that there are fatal defects in the work or the project?

Mr. BISHOP. None, whatever; they would hardly come to me.

Mr. STEVENS. No; but if employees discussed that phase of the subject, and were dissatisfied on account of that phase of the subject, would not that reach you?

Mr. BISHOP. It would be likely to.

Mr. STEVENS. Has that subject been discussed in any way with you by employees?

Mr. BISHOP. Not in any way that I would call serious.

Mr. STEVENS. Have you heard of any such thing that would require official action on your part?

Mr. BISHOP. None, whatever.

Mr. STEVENS. If any complaints of a serious nature affecting the general purpose of the work came to you from employees, what would you esteem it your official duty to do?

Mr. BISHOP. To report it immediately to the chief engineer.

Mr. STEVENS. Has that ever been done?

Mr. BISHOP. It never has.

Mr. STEVENS. Have you any connection with the department of civil administration?

Mr. BISHOP. None whatever.

Mr. STEVENS. Where are the records of the commission?

Mr. BISHOP. They are kept in the different departments; each department keeps its own records. I have the library of the commission I had in Washington, and I keep the records of my own department.

Mr. STEVENS. Have you any connection with the relief or charitable organizations, such as the Y. M. C. A.?

Mr. BISHOP. Yes; I am a member of the advisory committee which directs the operation of the clubhouses as carried on by the Y. M. C. A.

Mr. STEVENS. What, in your judgment, is the effect of the direction and maintenance of those clubhouses?

Mr. BISHOP. Most excellent. I will go further than that and say that they are absolutely necessary to the contentment of the force, and, consequently, to its efficiency.

Mr. STEVENS. What, if any, complaints come to you concerning their maintenance and method of operation?

Mr. BISHOP. None whatever. The men seem to be satisfied, and they are even content with the mild restrictions in the control of clubhouses on Sundays; that is, stopping certain games. The only complaint we have is that there are not more of these clubhouses, and I think there should be more.

Mr. STEVENS. Where would you place the additional ones?

Mr. BISHOP. We have recommended four—one at Gatun, one at Las Cascadas, one at Paraiso or Pedro Miguel, and one at Ancon.

Mr. STEVENS. And where are those now in existence?

Mr. BISHOP. In Culebra, Empire, Gorgona, and Cristobal.

Mr. STEVENS. What do they cost, each?

Mr. BISHOP. I think, completely furnished, the larger ones cost \$35,000. We have recommended for smaller places less expensive ones.

Mr. STEVENS. Have you anything to do with disbursing of accounts?

Mr. BISHOP. No, sir.

Mr. STEVENS. Anything to do with the department of sanitation?

Mr. BISHOP. No, sir.

Mr. ESCH. You say you had the first hearing of grievances?

Mr. BISHOP. Yes; such as were referred to me by the chairman.

Mr. ESCH. Has any complaint come to you recently from conductors?

Mr. BISHOP. Yes; that is now pending; the hearing is on Sunday, January 17. It was referred to me by the chairman, who appointed for it a special board in accordance with the plan laid down by him before the Secretary of War, which the Secretary of War and the President approved; that is, there should be one representative of the commission, one of the craft to which the complainant belongs, and one representative of the immediate higher official. We hold the first meeting on Sunday because the men are at work on week days.

Mr. ESCH. So that matter is in process of adjustment?

Mr. BISHOP. Yes.

Mr. ESCH. In dealing with complaints from the employees do you or does the commission recognize labor organizations as such?

Mr. BISHOP. Not at all.

Mr. ESCH. In what way, then, must complaints come before you or before the commission?

Mr. BISHOP. They come generally in the form of a letter from the complaining person; a letter to the chairman stating his grievance.

Mr. ESCH. Are the men encouraged to personally bring their grievances to the commission?

Mr. BISHOP. They are. Notices are posted in all mess houses and commissaries that if employees have any cause for grievance it should be sent to me.

Mr. ESCH. Then they have not got to go through any intermediary nor through your immediate superior, but have direct access to you or to the chairman of the commission?

Mr. BISHOP. Yes.

Mr. ESCH. And you two are those who hear and adjust grievances, as I understand it?

Mr. BISHOP. Yes. I may say that formerly we had a good many complaints from the foreign laborers, Spaniards and Italians; nothing serious ever from the West Indians; but these troubles were due to dissatisfaction with food and with money complications about their payment, which arose from speaking different languages. These have almost all disappeared, and we have no complaints from the mess houses, and a very few about the settlement of wages.

Mr. ESCH. Are only American citizens considered in the application of the eight-hour law?

Mr. BISHOP. Yes; I think that is so.

Mr. ESCH. Are any exceptions advisable to that provision?

Mr. BISHOP. I would rather you would ask the chairman.

Mr. ESCH. Did the French publish a weekly magazine or paper?

Mr. BISHOP. They published a monthly magazine; that is where I got the idea for the Record. It is the only source for certain data which we have now for French excavation, etc. The defect was that De Lesseps through his financial troubles used it largely as a personal organ to advance his schemes and eulogize himself. Our publication differs entirely. We have a rule not to put in the Record anything praising any official connected with the commission. The personal element is completely eliminated.

Mr. ESCH. Any advertising?

Mr. BISHOP. None whatever.

Mr. ESCH. What is the plan of distribution of that publication?

Mr. BISHOP. Every gold employee of the commission and Panama Railroad receives a free copy. If he wishes an extra copy he can buy it for 5 cents at the news stands. About 10,000 are distributed on the Isthmus. I submit a statement which covers all data in connection with the publication and distribution of The Canal Record.

Mr. ESCH. Who has charge of the immediate printing of the publication?

Mr. BISHOP. The commission printing office located in Panama.

Mr. ESCH. Is that in charge of an employee of the commission?

Mr. BISHOP. Yes; it is under the Quartermaster's Department, of which Major Devol is the head.

Mr. ESCH. What can you say as to the benefit of such a publication?

Mr. BISHOP. I think it is very great. I think it has in every way stimulated wholesome rivalry between the various divisions. Previous to its publication the men in one division knew nothing about what the men in another division were doing; they had no means of communication whatever. Now, by publishing in this paper the

work of each division, especially that done by steam shovels and dredges, a healthy rivalry has been aroused which has increased the efficiency of the men.

Mr. ESCH. I can see that it would be a very valuable medium for the transmission of orders and things of that kind.

Mr. BISHOP. Yes, it is; and for purposes of reference. It is used universally in the offices as a reference book. Then, I think through the use of its columns for what we call the "Woman's Club movement" it has encouraged the growth of that movement, which has done a great deal for the contentment of the families on the Isthmus.

Mr. STEVENS. I hold in my hand an extract from the Minneapolis Journal of December 19, 1908, in which it is stated that the consular officers could inform the commission a great deal concerning the hardships of the foreign laborers. Has anything come to you concerning that?

Mr. BISHOP. I think I could inform the consular agents of more than they could inform us.

Mr. STEVENS. Have they conferred with you?

Mr. BISHOP. Yes; they confer with me constantly at my office. The commission has employed a man exclusively for troubles with European laborers. He speaks several European languages and is in touch all the time with the consular agents.

Mr. STEVENS. What do you do when a foreign consul complains to you?

Mr. BISHOP. I turn the matter over to this special man for report.

Mr. STEVENS. What does he do?

Mr. BISHOP. He goes to the man, he hears the complaint, and then makes a formal report to me.

Mr. STEVENS. What do you do then?

Mr. BISHOP. I bring the matter to the attention of the head of the division, or of the chairman, with recommendations as to the course desirable to pursue in order to remedy the evil, if there is one.

Mr. STEVENS. This newspaper statement also proceeds "As could the head of the English church there." Have the church authorities conferred with you?

Mr. BISHOP. Yes; a great deal.

Mr. STEVENS. So that foreign laborers feel that they can go to either the consul or the church and get in touch with your office?

Mr. BISHOP. Yes; the Spanish consul formerly gave us a good deal of trouble. He said to me a few weeks ago that he had no complaints whatever to make now. I asked him to investigate a complaint about the food at a new camp that was established; he returned the next day and said he would be glad to get the same food in Panama for himself that he found at that camp.

Mr. STEVENS. Have you any difficulties on that account with the various foreign consuls?

Mr. BISHOP. None whatever.

Mr. STEVENS. I now read another statement from the newspaper I spoke of: "Why, these Jamaicans and other West Indian negroes who are employed in digging the canal have not a right on earth. They are charged exorbitant prices for everything they eat or wear; they are forced to pay fancy rentals for shacks that are built on stilts over swamps, and are robbed and browbeaten every time they enter a railroad train." Have any such complaints come to you?

Mr. BISHOP. None whatever; they never have. The West Indians have given us very little trouble.

Mr. STEVENS. How much truth is there in that statement?

Mr. BISHOP. Not one particle.

Mr. STEVENS. Do you know that personally?

Mr. BISHOP. Yes.

Mr. STEVENS. Have any complaints come to you in that respect?

Mr. BISHOP. None.

Mr. STEVENS. If they had, you would have known it and investigated it?

Mr. BISHOP. Yes.

Mr. BARTLETT. Have you a hospital at Colon?

Mr. BISHOP. Yes.

Mr. BARTLETT. Have you had complaints from nurses there?

Mr. BISHOP. Yes; I have had some.

Mr. BARTLETT. Recently?

Mr. BISHOP. Not within the last six months.

Mr. BARTLETT. The reason for my inquiry is that Colonel Goethals handed me a letter. Do not you know of any recent complaints?

Mr. BISHOP. They have not been referred to me.

Mr. BARTLETT. Now, in reference to the eight-hour law. Do any of the skilled laborers work longer?

Mr. BISHOP. That is outside of my jurisdiction.

Mr. BARTLETT. And you decline to have any complaints submitted except through individuals?

Mr. BISHOP. I have never had occasion to decline; the chairman has that to do, but they always come from individuals.

Mr. BARTLETT. Have you had any complaints as to the severity of punishment for misdemeanor or small offenses?

Mr. BISHOP. No; I have had one complaint about the severity of a decision of the court, but I have no jurisdiction over this. That belongs to a separate department. We simply say we have nothing to do about that; that is the judicial department.

Mr. BARTLETT. No complaint about discrimination for the punishment of foreign laborers; anything of that sort?

Mr. BISHOP. None whatever.

LIST OF COMPLAINTS OF GOLD EMPLOYEES FROM AUGUST 1, 1907, TO MAY 14, 1908.

August, 1907. John O'Brien, Gorgona shops, complains of unfair treatment. Investigation showed misunderstandings, and he is recommended for promotion.

John A. Weaver, timekeeper, division of municipal engineering, complains regarding his discharge. Investigation showed his dismissal justifiable, and because of his unsound mental condition he was given free transportation to the States.

Harry A. St. Claire, timekeeper, division of municipal engineering, complains regarding his discharge. Investigation showed him guilty of fighting in office, etc., and that his dismissal was justifiable. He was given opportunity to obtain a transfer, and declared himself satisfied.

George B. Halloran, clerk, division of municipal engineering, complains of unjust treatment in regard to promotion. Investigation

showed him worthy of promotion, and the same was recommended and given.

August 13, 1907. Samuel B. Harry, division of building construction, claims he was discriminated against by his chief, who refused to allow him to transfer to another department. Investigation showed transfer finally given him, so case dismissed, this being his principal grievance.

August 17, 1907. Joseph M. Tighe, clerk, La Boca division, complains of ill treatment and reduction in rank and pay. Treatment shown to have been justifiable, and he was continued in his present position.

August 19, 1907. J. H. Dowell, trainman, complains of unfair treatment in regard to his discharge. Investigation showed, September 24, that his dismissal was justifiable.

September 5, 1907. Albert C. Tall, carpenter, division of building construction, complains of his discharge owing to a reduction of force. Recommendation made for his reemployment, which was given him.

September 23, 1907. W. R. Cole, locomotive engineer, complains of being excluded from commission hotel at Gatun for disorderly conduct. Hotel's treatment found justifiable, but he is again allowed privileges of the hotel in November, 1907, and he expressed himself verbally as satisfied with the verdict.

September 23, 1907. Case of Robert L. Goodley, discharged on account of refusal to support wife. As result of investigation, showing that his wife was intemperate and not worthy of support, he was given clearance papers by the chairman and reemployed.

September 24, 1907. William Clarke, carpenter, complains of ill treatment by commission hotels at Las Cascadas. October 16 reports of Labor, Quarters, and Subsistence Department showed that there had been no unjust treatment.

October, 1907. A. J. Tuttle protests against his discharge. His discharge found justifiable, and his request for a clearance not recommended.

October, 1907. W. J. Thomas, engineer, cold-storage plant, Cristobal, complains of his discharge. Dismissal found justifiable, but he is recommended for other employment, which was offered.

October 6, 1907. George Bourliame, division of building construction, complains of unjust discharge, etc. October 14, 1907, evidence showing that his discharge was justifiable, case was dismissed.

October 31, 1907. Chas. Jordan, machinist, Paraiso, protests against his five-day lay off without pay. Investigation finally dropped on account of failure of Jordan to attend the same.

November, 1907. Cecil McCalla claims compensation on account of removal from lands forming part of Gorgona watershed. Advised that legal authorities state his claim is without foundation.

November 5, 1907. Case of Will A. Gilmore, division of building construction, who was discharged, investigated. Gilmore left Isthmus before investigation completed.

November 5, 1907. Hermann Golke, division of motive power and machinery, complains of unjust discharge. Dismissal found justifiable, but Golke given position at lower wages.

November 13, 1907. John Lawrence, carpenter, complains of unjust discharge. Investigation finally dropped on account of failure of Lawrence to reply to communications.

November 21, 1907. William R. Newbold requests compensation for loss of registered letter containing \$25. Director of posts, Ancon, advises that the matter has been taken up with chief post-office inspector, Washington, D. C.

November 23, 1907. Miss J. E. Burns, nurse, Colon hospital, complains of unjust discharge. Complaint withdrawn before investigation concluded.

November 25, 1907. Henry Anderson, carpenter, division of building construction, claims that he was injured while at work during the month of June, 1907, so that he was unable to continue work, and that he was refused "sick" or "injury leave" pay. January 2, 1908, head of his department advises that as Anderson made no report at time of injury, and that as he did not possess a doctor's certificate he could not be paid for such time, doctor's certificate being required in all such cases.

November 27, 1907. Percy W. Davis, clerk, office of master mechanic, Gorgona, complains of unjust treatment regarding his promotion. December 4, 1907, Mr. Davis advised that the full promotion was not made, because the same was not recommended by his chief.

December 3, 1907. Miss Eva Blanche Ramer, nurse, Colon hospital, complains of unjust discharge. Investigation arrested on request of Miss Ramer that she be permitted to withdraw her complaint.

December 5, 1907. John Wilson, ex-employee, makes complaint; referred to Major Sibert. No papers in our file showing final result.

December 5, 1907. Mrs. J. F. Agnew, nurse, Ancon hospital, complains of ill treatment and of being asked to resign without cause. December 11 case turned over to chief sanitary officer for final action.

December 20, 1907. F. E. Parker, assistant foreman, Corozal, complains that colored employees are unfairly treated by the Pedro Miguel commissary. January 31, 1908, result of investigation showed no just cause for the complaint.

December 20, 1907. John C. Webber, carpenter, division of building construction, complains of unjust discharge by his department and of ill treatment while in Ancon hospital. Found not to have been ill treated. Webber left the Isthmus before investigation completed.

December 24, 1907. Frank R. Bishop, clerk, master mechanic's office, Empire, who was discharged on account of intoxication, applies for reinstatement. January 4, 1908, advised that his application was refused, being contrary to commission rules, and investigation not showing any grounds for an exception in his case.

December 24, 1907. Charles L. Higgins, carpenter, Corozal, complains of ill treatment by the commissary. January 8, 1908, case settled by commissary satisfactorily to Mr. Higgins.

March 5, 1908. Bart N. Carrick, ex-employee, division of municipal engineering, claims back commutation. Claim disapproved after complete investigation, his case being unsustained by proofs.

April 28, 1908. Joseph A. Ferguson, foreman, La Boca division, complains of harsh treatment by zone courts, also by his own department in not paying him for time lost while attending court on account of his assaulting a laborer. April 30 advised that commission and courts are entirely independent of each other and that commission had no authority to pay him for lost time.

May 14, 1908. Joseph A. Ferguson, La Boca division, claims that he should receive pay for difference in time from the date he was first directed by the Washington office to sail for the Isthmus and the date, six days later, on which he was given transportation and sent to the Isthmus. Advised that his "terms of employment" provide that employees shall receive pay only from actual date of embarkation from the United States.

SUPPLEMENTARY LIST OF COMPLAINTS OF GOLD EMPLOYEES FROM
MAY 15, 1908, TO JANUARY 7, 1908.

May 26, 1908. John E. Wilson, Pacific division, La Boca, complains of unjust discharge. Investigation showed no good grounds for the complaint.

August 11, 1908. Jos. M. Tighe, Pacific division, La Boca, complains of unjust discharge, and that he was not given clearance papers. Investigation showed that his discharge was justified, and he was given transportation to the States.

September 5, 1908. Daniel J. O'Connor, Pacific division, La Boca, complains he was discharged without being given the five days' notice. Investigation showed that his discharge was justified.

September 18, 1908. Edward Christman, car-repair shops, Gorgona, complains about being discharged, and requests to be reinstated. Investigation showed that his discharge, on account of drunkenness, was justified; and he was not reinstated.

October, 1908. William H. Anderson, Jeremiah Smith, A. H. Wallace, I. G. Hill, J. S. Johnson, and M. McGrath, all working in the Panama railway shops, Cristobal, complained of discrimination against them, and of unjust discharge. As a result of the investigation their discharge was sustained, but no objections made to their obtaining reemployment with Panama Railroad or the commission.

December, 1908. C. C. Barnett, secretary of committee of Isthmian conductors, Las Cascadas, Canal Zone, presents a list of grievances of the conductors. Case pending, arrangements being made for a hearing on Sunday, January 17, 1909.

CANAL RECORD STATEMENT.

The first year of the Canal Record was completed on August 26, 1908. There were published in all during the year 627,425 copies. The average number published weekly was 12,000. The total cost of paper, composition, and printing was \$6,349.22. There were sold 33,450 copies, at 2½ cents, making total receipts from sales \$836.25, and making the net cost \$5,512.25, or a little less than 1 cent a copy.

Of the total number printed 1,800 were sent each week to the Washington office of the commission for distribution in the States, and about 10,000 were distributed each week on the Isthmus among officials and employees of the commission and the Panama Railroad Company. There were also sent to the Washington office at the close of the year 1,500 full sets of the 52 issues of the year, which have been bound, with a complete alphabetical index. The larger part of these bound volumes will be distributed in the States among Senators and Members of the House of Representatives, newspapers, public libraries, libraries of colleges, technical schools, engineering societies, and

leading engineers and others professionally interested in canal construction. The others will be distributed among the various offices of the commission on the Isthmus for reference use.

The cost in salaries paid for collecting and preparing information in the Canal Record during the year was \$3,400. This, added to the cost of publishing given above, makes the total cost for the year \$8,912.97, or a little more than 1 cent a copy.

STATEMENT OF MAJ. C. A. DEVOL, U. S. ARMY.

Mr. ESCH. What is your name and official position?

Major DEVOL. C. A. Devol, chief quartermaster of the Isthmian Canal Commission.

Mr. ESCH. How long have you been in the employ of the commission?

Major DEVOL. Since July 15 last. I arrived here July 1 and assumed charge of what was labor, quarters, and subsistence, with the subsistence department eliminated.

Mr. ESCH. You now have jurisdiction over what?

Major DEVOL. I now have jurisdiction over what was labor and quarters and the material and supply departments. I took the material and supply department on the 1st of September, having taken the labor and quarters on July 15, consolidating all material and supplies with the labor and quarters portion of labor, quarters, and subsistence department.

Mr. ESCH. Let us consider supplies first. What do these supplies consist of principally that you have to purchase for the use of the commission?

Major DEVOL. They consist of all supplies for the construction and engineering of the canal.

Mr. ESCH. Where are those supplies purchased?

Major DEVOL. In the United States almost entirely, with the exception of a few supplies that are purchased on the Isthmus, which are very inconsiderable.

Mr. ESCH. What do those supplies amount to annually or semi-annually, if you have any amount?

Major DEVOL. Last year, in rough figures, about \$11,000,000.

Mr. ESCH. How do you purchase, competitive bids?

Major DEVOL. Almost entirely. The method of purchase is instituted by requisitions here which, before being forwarded, are submitted to the chairman for his approval and then sent to the purchasing office in Washington and they advertise for thirty days in all parts of the United States, except on certain emergency purchases, where the advertising is cut down to ten days, and for purchases where the emergency is greater open market is made at once.

Mr. ESCH. And you have purchasing agents in the States?

Major DEVOL. In Washington; yes.

Mr. ESCH. Anywhere else?

Major DEVOL. There is a branch in New York City. The Panama Railroad Company purchase entirely through the Panama Steamship Company in New York; connected with that is Major Simpson, who now acts as agent of the Washington purchasing branch and purchases supplies also for the Isthmian Canal Commission.

Mr. ESCH. Did you not formerly have purchasing agents in New Orleans and on the Pacific coast?

Major DEVOL. There is one at New Orleans now, purchasing under the Panama Railroad Company and the Isthmian Canal Commission.

Mr. ESCH. What are your shipping ports in the United States?

Major DEVOL. Largely from New York, Newport News, Gulfport, Mobile, Galveston, and Portland. Lumber is shipped from the southern coast and supplies shipped from New Orleans to some extent, but such supplies from New Orleans are mostly commissary supplies with which I have no connection.

Mr. ESCH. Your lumber purchases are from what section?

Major DEVOL. From the northwest Pacific coast, and the Southern States. *

Mr. ESCH. What percentage of all supplies comes through New York?

Major DEVOL. Well, I can only make a rough estimate; I should say 75 per cent.

Mr. ESCH. Is that because the supplies can be purchased nearer New York or because your steamships sail from New York?

Major DEVOL. Yes; because the Panama Railroad steamers sail from New York.

Mr. ESCH. Is that the controlling factor or are you influenced largely by the railroad rates in the United States to the shipping point?

Major DEVOL. The arrangement of the shipping of supplies lies with the purchasing office in New York; it is not under my control, and I can not state authoritatively what governs that. I presume all smaller supplies and supplies which are in a sufficient quantity to constitute a ship's cargo; the controlling factor is that we are running a steamship line from New York. Where the cargo is sufficient to form a shipload it would not be the fact; it would be sent from any port the most economical. Our supplies are what are called "c. i. f.," almost entirely, which is the same as f. o. b. at this port. Of course it is the shipper's responsibility in regard to shipping; he pays the freight.

Mr. ESCH. In advertising contracts it is left optional as to what port the goods should be shipped from?

Major DEVOL. Oh, yes; it simply means we advertise c. i. f. delivery at Colon or La Boca, and that means he can put it there any way he wants to.

Mr. ESCH. You exercise no control whatever over that?

Major DEVOL. No, sir.

Mr. ESCH. And he could use a foreign bottom if he desired?

Major DEVOL. I have no doubt he could.

Mr. ESCH. If you could make a contract with a foreign ship to deliver goods at Colon or Panama cheaper than a rival to ship goods on a vessel of American register, would he get the contract?

Major DEVOL. No way to prevent that, that I know of; we get shipments by the Royal Mail and the United Fruit Company.

Mr. ESCH. Do you know what percentage of your supplies is carried by Panama Railroad steamers?

Major DEVOL. I have never calculated that, but I should say about 60 per cent. Dynamite, which is a large item here, comes down by

tramp steamers, and all heavy structural steel and lumber and coal comes in tramp steamers. In my estimate I do not include anything purchased by the Panama Railroad Company; they purchase coal entirely.

Mr. ESCH. When the goods arrive at Panama or Colon are your supplies given a postage-stamp rate or a distance rate by the Panama Railroad?

Major DEVOL. We get a flat rate.

Mr. ESCH. What is that average per ton?

Major DEVOL. I do not know. A flat rate of \$57,000 per month was entered by authority of the commission for the transportation by the Panama Railroad of all Isthmian Canal supplies.

The CHAIRMAN. What do you mean by a flat rate?

Major DEVOL. So much per month.

Colonel GOETHALS. We pay the Panama Railroad \$2.25 per ton for shipments to all points—to Colon or Panama or to intermediate points a ton of freight costs the commission \$2.25. For coal, sand, or gravel, which we get in carload lots, we pay the flat rate of \$1.75, the object being to keep the Panama Railroad alive, at the same time allowing it to make no more money than the commission desires it to make. The rate is arranged between the commission and the Panama Railroad, the members of the commission being also directors of the Panama Railroad.

Mr. ESCH. Have you figured out, Colonel, whether the postage-stamp rate would develop a greater revenue to the railroad company than the flat rate?

Colonel GOETHALS. I do not know whether that has ever been figured out. The rate now paid by the Panama Railroad was an adjusted rate at the close of 1906, and each year the earnings of the Panama Railroad are carefully looked into and if we consider it advisable that rate is changed.

Mr. RICHARDSON. How many of the Panama commissioners are interested in the Pacific transportation?

Colonel GOETHALS. None, so far as I know.

Mr. RICHARDSON. What powder and what dynamite is now being used on the Isthmus, Major?

Major DEVOL. 45-60 per cent dynamite, purchased from the Du Pont Powder Company.

Mr. RICHARDSON. How long have they had the contract?

Major DEVOL. As long as I have been here. They have a contract which will run to September under the amounts which we are receiving now; about one million pounds per month.

Mr. RICHARDSON. Was the contract secured by competitive bid?

Major DEVOL. Yes.

Mr. RICHARDSON. What inspection, if any, is given to the supplies purchased by you and where is it made?

Major DEVOL. It is made primarily in the United States; all supplies are inspected by an agent of the purchasing agent in New York, but all our advertisements read that final inspection and acceptance will be by the Isthmian Canal Commission on the Isthmus. We give it a final inspection and it is not accepted until it is finally inspected here. All our supplies which arrive at Mount Hope are taken to the storehouse there and inspected by inspectors under my own jurisdiction and pay. We have a lot of other supplies going

directly to the various divisions upon arrival, and we issue what is called an "inspection call;" it goes with the consignment. After action by the consignee, this inspection call comes back and the bill from the dealer is then completed by me, either accepted or with a notation goes back to the United States.

Mr. RICHARDSON. You have found that that system works satisfactorily?

Major DEVOL. Very satisfactorily. Under this system there seems to be very few complaints. We make a number of exceptions and in the majority of cases we have no difficulty in getting accounts settled.

Mr. RICHARDSON. How large a force have you under your control on the Isthmus?

Major DEVOL. Practically 3,000; I have 272 gold men, the balance are what are called silver men.

Mr. RICHARDSON. And have you storehouses or warehouses along the Isthmus?

Major DEVOL. Yes; the main storehouse is at Mount Hope, in which the property accountability of all property coming on the Isthmus is taken up. Every article which comes here is taken up, and the accountability begins there and ends with the official consignee and disposition of the property on the work. We have two other main storehouses, one at Empire and one at Gorgona. Empire carries a stock that will run perhaps \$850,000 or \$900,000; Gorgona carries a stock of about \$500,000. The entire stock on the Isthmus at present amounts to a little over \$3,000,000.

Mr. RICHARDSON. So that you can trace the responsibility for any given article from the time it reaches Colon to the time of its actual use?

Major DEVOL. Yes, sir. We have placed recently, with the approval of the Secretary of War, a physical system of property accountability which has been taken up since my arrival. It is mapped out largely on the loose-leaf ledger system which was successful in the Quartermaster's Department in the United States. By that system every article has a page showing a debit and credit of that article. Each accountable officer has this loose-leaf ledger and they make their entries with the carbon process. At the end of six months the carbons are sent to my office and the returns from all accountable officers are checked. All the debits and credits must check against each other in my office.

Mr. RICHARDSON. Supposing an article is not accounted for, who is held responsible?

Major DEVOL. The last accountable officer who has not shown disposition.

Mr. RICHARDSON. Is he under bond?

Major DEVOL. No, sir.

Mr. RICHARDSON. How do you enforce your accountability?

Major DEVOL. It becomes a charge against their pay.

Mr. RICHARDSON. You use the same system practically here that is used in the Quartermaster's Department in the army, even to details?

Major DEVOL. Yes, sir. Some of the details are omitted. We have to add to this a system of cost keeping on the Canal Zone which does not obtain in the Quartermaster's Department. It is different there, because appropriations cover the different articles. Here an

article goes into the work, and it must be charged to that particular portion of the work of which it becomes a part; therefore, in addition to the physical accountability there has to be a cost-keeping account.

Mr. RICHARDSON. In your experience while on the Isthmus what percentage, if any, of the articles have not been accounted for, either in amount or value?

Major DEVOL. I can not arrive at a percentage at this date. This system was inaugurated since my arrival. It was made effective October 1, 1908. Previous to this time there was a financial accountability. We have changed from the financial system to the physical system. After I get an audit on these returns which come in after the 1st of January, there will be some data from which to get an answer to that question.

Mr. RICHARDSON. Is the loss inconsiderable?

Major DEVOL. In my opinion it is entirely so, because, for one reason, there is no place for the disposition of stolen property.

Mr. HUBBARD. Are inventories made periodically or otherwise of the stock of these warehouses?

Major DEVOL. I have a man constantly on the road called "the inventory man." He goes from one storehouse to another and takes what we call a test inventory. He will take out five or six prominent articles and calls for stock cards on these articles. He will then go through the stock and check those articles, and if he finds anything radically wrong he will report the matter to me and we will call for a complete inventory. I have inventoried since I started out nearly every storehouse on the Isthmus; some of them checked out to an article; some were not so good.

Mr. ESCH. Are your assistants army officers or civilians?

Major DEVOL. I have two assistants—one, Lieutenant Wood, who is an army officer, and another, Captain Nixon, at the Mount Hope storehouse, who is also in the army.

Mr. ESCH. You purchase the steel rails used on the Isthmus?

Major DEVOL. They are purchased in the United States.

Mr. ESCH. Through the Panama Railroad Company?

Major DEVOL. No; through the Washington office.

Mr. ESCH. Have you had any complaints coming from the States with reference to the method of advertising for bids?

Major DEVOL. None since I have been here.

Mr. ESCH. Has there been any complaint from sections of the United States on the ground that they were discriminated against or not given a fair share in the sale of either products?

Major DEVOL. There has been considerable correspondence with California.

Mr. ESCH. What did they arise from?

Major DEVOL. California has claimed that they did not participate in a fair share of the business on the zone, one reason being that they did not have the transportation facilities that are offered on the Atlantic side. The Pacific Mail Steamship Company is the only regular steamship line between California and the Canal Zone. They run about a twenty-five day schedule, and it will take that time to get their products here against six days on the Atlantic coast. Then again, the rates lie with the Pacific Mail, there being no competition. I believe that lately Mr. Schwerin is making the same rate as applies on the other side. When I was in San Francisco I took this matter

up with Mr. Schwerin, who is the general manager of the Pacific Mail Steamship Company. I was then the local agent of the Isthmian Canal Commission, making a few purchases. I asked him if he could not make the same rate as on the Atlantic coast, which was \$5 a ton; his rate was \$8 a ton; he said he could not make the rate because the business on the canal was very inconsiderable; that it did not amount to anything, and that if he made a rate of \$5 a ton it would have to apply to all his freight shipments here, and it would not pay just to get the little business in connection with the canal. But I think that recently he has made a rate.

Mr. KNOWLAND. Last night the statement was made that the purchases made by you were made delivered at Panama, and of course if any special rate was made you would not know it, but they would be able to bid that much lower.

Major DEVOL. This line would have to compete to do the business over there.

Mr. KENNEDY. That line would have to compete with the other lines if they wanted to do the business?

Major DEVOL. Yes.

Mr. KNOWLAND. Did Mr. Schwerin say anything about making a rate of that amount provided a sufficient amount of material and supplies was purchased there?

Major DEVOL. No, sir. He said the business would not warrant the reduction; we did not go into the possible future, as I recall the conversation.

Mr. KNOWLAND. He did not say he would make the rate if a sufficient amount of supplies was purchased?

Major DEVOL. No; but I take it for granted he would.

Mr. CUSHMAN. With special reference to lumber; among other commodities do you have charge of the lumber purchases?

Major DEVOL. Yes, sir.

Mr. CUSHMAN. How many different kinds of lumber—I do not mean grades but kinds—do you purchase?

Major DEVOL. We purchase a large number of kinds.

Mr. CUSHMAN. I refer to southern pine, fir, and general specific kinds of lumber.

Major DEVOL. We purchase long and short leaf yellow pine, cypress, Oregon fir, and we purchase a small amount of hard lumber, oak, for car repairs.

Mr. CUSHMAN. Where does the yellow pine come from?

Major DEVOL. From the Southern States.

Mr. CUSHMAN. And the fir comes from the Pacific northwest?

Major DEVOL. Yes, sir; entirely.

Mr. CUSHMAN. Some complaints have been made to me, Major, by the lumber interests of Oregon and Washington that their lumber was discriminated against in the advertising calling for bids. For instance, one was brought to my attention where the advertisement of the commission called exclusively for yellow pine, absolutely excluding the possibility of those in the Northwest putting in any bid for fir.

Major DEVOL. There may have been some cases of that kind. There is one reason for it which came up lately. For instance, the Atlantic division put in a requisition for some timber for a cement shed. They specified yellow pine or fir. Well, now, there is no place

to get the fir but in the Northwest. He said, "immediate delivery required." It was then advertised that way. It takes four months to get any fir from the Northwest down to this port. I had a complaint from the division engineer who made this requisition the other day asking for this lumber. From the fact that he specified fir, the earliest delivery secured from Washington was March 2, whereas all the other material was assembled here in December. That means it will be March before he can get the timber.

Mr. CUSHMAN. It would seem to me that the purchase of lumber, being a staple for use in the cement sheds, could be determined in advance with almost the same amount of certainty you can determine the purchase of cement.

Major DEVOL. In this particular case I do not know; it was from Major Sibert for a cement shed, and I do not know what advance information he had, but it called for immediate delivery. I do not know why; I presume the plans were formulated hurriedly in regard to the cement shed, but in the general supply of lumber we have ample time to give the Pacific coast a chance to bid. For example, the La Boca dock was so congested last month with Pacific coast lumber that we could not turn around for a month.

Mr. CUSHMAN. I did not mean to apply any criticism, but I thought I would only call your attention to the fact that those complaints were made to me with considerable severity sometimes.

Major DEVOL. In all general supplies we have anticipated our wants and have lumber here now to last for some time. In fact, we have had too much lumber; we have been congested on the Pacific side and have now more than we can handle. I just mentioned that incident; you can not count less than four months if you want it in a hurry; that is why we take yellow pine instead of fir.

Mr. CUSHMAN. Has yellow pine any advantages in general construction over fir?

Major DEVOL. No, sir; it has not, except in bridge construction.

Mr. CUSHMAN. Do you think the long-leaf yellow pine as bridge timber superior to Douglas fir?

Major DEVOL. I am not an expert on matters of that kind, but I know when I built docks the long-leaf yellow pine was largely satisfactory where you wanted great strength and durability.

Mr. CUSHMAN. Well, the Douglas fir is assumed to be far superior, especially for bridge timbers.

Mr. KNOWLAND. Is it a fact that the storehouse facilities are very inadequate at La Boca, which renders it less easy to make shipments from the Pacific coast?

Major DEVOL. This fact obtains. We are getting now again into the commissary department, but there are not the facilities for the storage of commissary supplies at La Boca that there are at Colon. When Major Wilson came here he had that matter up with me and I arranged to turn him over a warehouse there that would take care of it. We arranged so that if they could ship the stuff down here we would get the storage facilities. They are not inadequate, but they are not nearly as much as on the other side. If the bids are placed and the goods come down on the Pacific side the storehouse facilities will meet the conditions without additional expense.

Mr. KNOWLAND. I understand that advertisements for California beans were printed to be delivered in New York.

Major DEVOL. That is in Major Wilson's province; I have nothing to do with that. That is subsistence supply.

Mr. HUBBARD. Are printing supplies in your department and under your jurisdiction?

Major DEVOL. Yes; there are two printing plants, one in Panama and one in Colon. One is under my jurisdiction and the other under the Panama Railroad Company. We are now arranging to combine the two and to place the entire plant at Colon, which will be under the depot quartern aster at Mount Hope, and we expect to have it effective in two months time; the object being to consolidate and cut down expenses.

Mr. HUBBARD. What do those expenses amount to under the present system?

Major DEVOL. The plant in Panama is operated at an expense of \$3,800 per month; this is the amount of the payroll; the output is about \$4,700 per month. Of course I am without information in regard to the printing plant of the Panama Railroad. I presume they print largely the tickets, etc., pertaining to the railroad.

Mr. HUBBARD. Is all printing for the Commission proper done at the plant here?

Major DEVOL. Yes, sir.

Mr. HUBBARD. Do you purchase machinery, presses, etc.?

Major DEVOL. The plant was all here when I came; the gasoline engine and the presses. When we consolidate it will not be necessary to buy more.

Mr. HUBBARD. Can you state the amount of the investment of the plant here?

Major DEVOL. I can not.

Mr. HUBBARD. Has any inventory been made since you have been in charge?

Major DEVOL. Yes, a physical inventory.

Mr. HUBBARD. No valuation?

Major DEVOL. I have not valued it.

Mr. HUBBARD. How many printers are employed here?

Major DEVOL. There are 13 compositors.

Mr. HUBBARD. Who has immediate charge of the printing office here?

Major DEVOL. A man named William Krugel, who is a printer and has immediate charge.

Mr. HUBBARD. How many men are on the pay roll which he approves?

Major DEVOL. His pay roll amounts to \$3,800 a month. There are 65 men including himself. That includes 50 silver men. Some of them are Panamanians and some are West Indians.

Mr. HUBBARD. Are they skilled or common laborers?

Major DEVOL. They are really skilled men with common laborers' wages. The rates are 32½ cents silver per hour, 30 cents, 25 cents, 21 cents, 19, 15, 12, 10, 7, and 5 cents right down the scale, per hour. These men who do the printing are compositors and they average \$2 gold per day. I understand in the United States they get about \$4 gold per day.

Mr. HUBBARD. You pay here then about one-half what is paid in the United States?

Major DEVOL. Yes, sir. It is based on the rate they pay printers for other commercial work in town.

Mr. HUBBARD. Have you any information as to the amount of the pay roll at the Colon plant?

Major DEVOL. No, sir; it is not under my jurisdiction.

Mr. HUBBARD. In what way is it expected to reduce expenses by consolidating the plants?

Major DEVOL. There will be one man in charge to run the whole plant and we hope for the usual results of consolidation; that it will result in economy.

Colonel GOETHALS. Also in the transportation of paper and supplies and of the finished product, most of which is delivered at Culebra and Empire.

Mr. HUBBARD. The distribution cost would be less?

Colonel GOETHALS. Yes.

Mr. HUBBARD. I do not remember that you stated the amount paid by you for paper and other supplies.

Major DEVOL. That comes in a total charge. The total output per month figures, roughly, \$4,700.

Mr. HUBBARD. I understood that to be the value of the finished work that you distributed.

Major DEVOL. Yes.

Mr. HUBBARD. What I am inquiring about, Major, is the cost of paper, ink, and other supplies which you purchase.

Major DEVOL. Here is one month's business; the material is \$1,400 and the labor is \$2,200.

Mr. HUBBARD. Is that the average proportion?

Major DEVOL. That is an average month's business.

Mr. KNOWLAND. What character of supplies come from Galveston and the Carolinas other than lumber?

Major DEVOL. Forage; the last shipment of forage came from Galveston.

Mr. KNOWLAND. What comes from New Orleans?

Major DEVOL. Cypress ties, from that vicinity, in my department; not much else but a great deal of commissary supplies.

Mr. BARTLETT. Are they brought in foreign or American vessels?

Major DEVOL. They are brought in vessels of the United Fruit Company.

Mr. BARTLETT. Are they of foreign or American register?

Major DEVOL. Foreign.

Mr. BARTLETT. What would be the effect if all the supplies should be brought to the Isthmus in American vessels?

Major DEVOL. American vessels would have to compete with present rates or the cost of supplies would be increased.

Mr. BARTLETT. What would be the effect if from now on the supplies would increase in amount; the cement will require more transportation. will it not?

Major DEVOL. Oh, yes; four and one-half million barrels of cement are coming down. I should say for three years there certainly will be no decrease, and probably, perhaps, an increase. After three years, probably a decrease.

Mr. BARTLETT. What would be the effect on the work here if it was required that all supplies be brought to the Isthmus in American vessels?

Major DEVOL. I should say it would materially increase the cost of the work.

Mr. BARTLETT. To what extent?

Major DEVOL. I am unable to say. It depends on what the American shipping industry would do. If they had the ships they could take care of the business, but I do not know if any steamship line would go to New Orleans and put on a line.

Mr. BARTLETT. Would it retard the work besides increasing expense?

Major DEVOL. I do not know; I presume the supplies would have to come from some other port where American lines could handle it. I should think it would increase the cost of the work.

Mr. BARTLETT. As much as 20 per cent?

Major DEVOL. I do not know; I would not think that much.

Mr. ESCH. We have purchased two ships for the Panama Railroad Company of very much larger tonnage than any we have, and they are to be delivered here some time this spring. If they are put into commission would that lower the freight rates—because of their larger tonnage?

Major DEVOL. They are government ships; I should imagine they should lower the expense, because they can be more economically handled than a smaller ship. They are good ships.

Mr. ESCH. Yes; but when you figure you have little or no return cargo, can they be more economically run in the Panama Railroad trade than the ships they now have?

Colonel GOETHALS. They can not; they can not come down with the full load that the ships can carry, for our present facilities at Colon will not permit them to dock. If loaded to full capacity we would have to lighter at least part of the cargo; they are too large for our purposes.

Mr. ESCH. Then the conclusion might be drawn that they should not have been purchased?

Colonel GOETHALS. They should not have been purchased, so far as the commission is concerned.

Mr. ESCH. The ships that are now in the trade are the ships of the proper size to most economically handle the trade?

Colonel GOETHALS. Yes.

Mr. ESCH. Would the loss of the steamship *Finance* render it necessary to have purchased at least one of these larger ships?

Colonel GOETHALS. No. An additional ship was necessary for cold-storage supplies, but not for handling construction supplies.

Mr. ESCH. Is it not better to have your cold-storage supplies come more frequently in smaller quantities than at lesser intervals in large bulk?

Colonel GOETHALS. Very much better.

Mr. HUBBARD. By a larger vessel?

Colonel GOETHALS. Oh, no; I did not so understand the question.

Mr. STEVENS. Who has charge of procuring the labor, Major?

Major DEVOL. I have.

Mr. STEVENS. Have you any difficulty in getting sufficient labor?

Major DEVOL. No.

Mr. STEVENS. Have you any complaints from the foreign laborers when they come here?

Major DEVOL. No; we have had no complaints practically at all, except an occasional complaint that comes through from Mr. Bishop. They come to him more than to me.

Mr. STEVENS. You have no difficulty in getting foreign labor?

Major DEVOL. No, sir. The matter of the recruiting of labor seems to have settled itself within the last five months.

Mr. STEVENS. You get your white labor the same way?

Major DEVOL. Yes.

Mr. STEVENS. When you want men for particular tasks you have no difficulty in getting them?

Major DEVOL. None at all.

Mr. STEVENS. What proportion of the men you get come from the Civil Service Commission—I mean of the white gold roll?

Major DEVOL. All the clerical force.

Colonel GOETHALS. All clerks, physicians, draftsmen, and nurses are from the civil service; others are by direct appointment.

Mr. BARTLETT. How many men are on the silver roll?

Major DEVOL. Approximately 40,000 on the rolls—that is, the number on the rolls, but not the number employed. The number employed is about 30,000. This obtains from the fact that one man will appear on a roll two or three times during a month, and the entire force is not working all the time. There are 4,998 Americans, 5,900 Europeans, and 29,000 West Indians.

Mr. HUBBARD. Is that the number on the rolls?

Major DEVOL. Yes; the actual force on November 1, 1908, was 30,701; they divide up in the same proportion.

Mr. BARTLETT. How many United States negroes have you here?

Major DEVOL. A very few; I should say about 100.

Mr. BARTLETT. Have you made any effort to get them?

Major DEVOL. No, sir.

Mr. ESCH. Are they put on the gold roll?

Major DEVOL. In some cases.

Mr. ESCH. Does the eight-hour law apply to them?

Major DEVOL. Yes.

Mr. BARTLETT. Are the firemen on the engines gold men?

Major DEVOL. No gold men; they are all silver men.

Mr. BARTLETT. All the firemen on the engines?

Major DEVOL. Yes; all the firemen and, I think, a certain number of the engineers.

Mr. BARTLETT. Negroes?

Major DEVOL. Yes, sir; I believe so.

Mr. BARTLETT. Well, on the engines that do the work of the Canal Commission?

Colonel GOETHALS. There are, I believe, three negro engineers on the Central division, two on the Pacific division, and one on the Atlantic division. I have had occasion to look that up recently, as the locomotive engineers objected to the employment of these negroes as engineers. They are used for switching in the yards.

Mr. BARTLETT. I understood you to say that would be altered?

Colonel GOETHALS. I am looking into it with a view to a change, not because of the protest of the engineers, but in looking into the cost of the up-keep of the engines I find that the negroes are not as competent to make repairs as the white engineers. These negroes are at present on the silver rolls.

Mr. BARTLETT. These men you can work more than eight hours a day?

Colonel GOETHALS. Yes; the locomotive engineers and trainmen work nine hours a day.

Mr. BARTLETT. Major, you say you have about 100 United States negroes here; have you ever had more than that? Have you ever had more than are on the Isthmus at present?

Major DEVOL. I think there used to be more.

STATEMENT OF LIEUT. COL. GEORGE W. GOETHALS, U. S. ARMY.

Mr. STEVENS. Will you please state your name and official connection with the Isthmian Canal work?

Colonel GOETHALS. George W. Goethals, chairman and chief engineer of the Isthmian Canal Commission.

Mr. STEVENS. What has been your professional and official experience in this line of work?

Colonel GOETHALS. For six to six and one-half years I was engaged in work of construction of locks and dams, five years of this time on the Tennessee River and the remainder on the Ohio River. On the Tennessee River the Muscle Shoals has a longitudinal embankment of earth constituting a continuous dam 14 miles long, with 11 locks. I joined that work in time to complete it, and personally computed and designed a 26-foot lift lock and began its construction. The lock was subsequently completed on the original plans.

Mr. STEVENS. On which river?

Colonel GOETHALS. On the Tennessee River. I was in direct charge of construction work at Westport involving concrete and other classes of masonry; for three years on fortification work which required the laying of large masses of concrete; in one case, a battery for 6-inch guns was successfully completed on a soft foundation. My other experience has been along lines not especially connected with lock and dam construction, though I taught civil and military engineering for four years. I was appointed a member of the commission on March 4, 1907; I reached the Isthmus March 12, 1907, and was appointed chief engineer and chairman on April 1, 1907.

Mr. STEVENS. In your present capacity, what is your range of duties?

Colonel GOETHALS. As chief engineer, I am in charge of the department of construction and engineering, involving all construction work on the Isthmus. As chairman of the commission, I exercise supervision of all the departments not connected with construction and engineering—the department of civil administration, the department of sanitation, the examiner of accounts, the disbursing officer, and the quartermaster's and the subsistence departments. As president of the Panama Railroad, I have general supervision of Panama Railroad matters.

(Mr. Stevens announces that, with the permission of the committee, he will question Colonel Goethals as to engineering, the other gentlemen to undertake the examination as to civil government and the Panama Railroad.)

Mr. STEVENS. When you arrived at the Isthmus as chief engineer, what plans as to this project did you find?

Colonel GOETHALS. The present project, commonly known as the 85-foot level project, with the locks and dam as now being constructed at Gatun, and with the locks and dams projected on the Pacific side in the vicinity of Sosa Hill.

Mr. STEVENS. That was the project that had been approved by your superior officers as required by law?

Colonel GOETHALS. Yes, sir.

Mr. STEVENS. So that the project was not yours?

Colonel GOETHALS. No, sir.

Mr. STEVENS. What was your first duty in connection with that project—to examine it as to its practicability, or to put it into execution, or both?

Colonel GOETHALS. Both.

Mr. STEVENS. What did you find as to its practicability?

Colonel GOETHALS. I found, and subsequent examination and study have led me to conclude, that the project was, and is, entirely practicable and feasible. So far as the locks on the Pacific side were concerned, they projected into the Pacific Ocean, and as the canal is a military necessity to the United States the location of the locks on the Pacific side was objectionable from a military standpoint. When we reached the Isthmus, work had been begun looking to the construction of the dams at the La Boca end. The difficulties encountered in the construction of these dams was such as to lead us to make an estimate of the cost of carrying out that project and of modifying it by withdrawing the locks farther into the interior. The estimated cost for the change was less than the estimated cost for completing the locks and dams as originally designed; and, in view of the military necessities of the situation, with the approval of the commission, I reported the facts to my superiors and recommended that the project be changed, in so far as it relates to the Pacific side, by the location of the locks at Pedro Miguel and Miraflores. So far as the rest of the project is concerned, I have had no occasion whatever to change my opinion that the project is safe and can be built.

Mr. STEVENS. Did you give the project on the Atlantic side, at Gatun, the same investigation and scrutiny and desire to change, if advisable, that you gave on the Pacific side?

Colonel GOETHALS. I had no desire whatever to change on the Atlantic side, while I did have a desire to change on the Pacific side, for the military reasons already stated.

Mr. STEVENS. Was there any physical or engineering reason why the locks could not have been constructed at Sosa?

Colonel GOETHALS. No, sir.

Mr. STEVENS. It was a question, then, of strategic importance, in the first place, and economic importance in the second place?

Colonel GOETHALS. Yes, sir. There was never any doubt in my mind that the project as laid out could be constructed safely.

Mr. STEVENS. You conceived it, then, as your official duty to investigate conditions as to these matters from these standpoints that you have indicated, and report them to your superior officers?

Colonel GOETHALS. I did.

Mr. STEVENS. Did you give the same investigation on the Atlantic side at the Gatun locks and dam?

Colonel GOETHALS. Yes, sir. We investigated that even more thoroughly than we did on the Pacific side, and we found the condi-

tions, so far as the dam on the Atlantic side is concerned, much more favorable as to foundations than had been reported in the report of the board of consulting engineers.

Mr. STEVENS. Please make a statement to the committee, for the record, of what was the condition that you found and as now exists, and that leads you to decide that the plan is practicable and can be made effective.

Colonel GOETHALS. In the report of the board of consulting engineers, and subsequent congressional hearings, a certain amount of seepage through the foundations had been mentioned and provisions suggested to stop it. Our investigations show that the seepage that they anticipated will not be realized; that, except for the top stratum, the material is practically impervious to the passage of water.

Mr. STEVENS. What do you mean by "practically impervious?"

Colonel GOETHALS. Water will not get through the entire length of the substructure of the dam.

Mr. STEVENS. Why do you use the word "practically?"

Colonel GOETHALS. Water under proper pressure can get through almost any material. Water under pressure due to a head of 90 feet can not get through the blue clay, but does through the clay and sand forming the top stratum.

Mr. STEVENS. Is it of any consequence in the execution of the work?

Colonel GOETHALS. No.

Mr. STEVENS. Then, what will you do with the upper stratum that you state is not practically impervious?

Colonel GOETHALS. We are to cut off the seepage through that top stratum by sheet piling. I do not consider it as absolutely necessary, but it is an additional precaution.

Mr. STEVENS. Why?

Colonel GOETHALS. The magnitude and importance of the work and the criticisms that have been made of the Gatun dam are so great and many that we do not care to take any possible chances. Our investigations and reports indicate that seepage is found in the top stratum, and we would be subject to criticism if we did not attempt to stop it, so that we resorted to the sheet piling.

Mr. STEVENS. Then, do we understand that, as an engineering or practical business proposition, the upper stratum would be sufficient, without the piling, upon which to place the dam?

Colonel GOETHALS. I would not have considered such additional precaution necessary in the ordinary case, nor do I believe that I would have resorted to it were I building the dam in the United States, especially one with such enormous dimensions.

Mr. STEVENS. In your knowledge and experience of engineering projects, do you know of any other dams of importance where conditions similar exist?

Colonel GOETHALS. If my memory serves me right, they had seepage in the upper stratum at the Wachusett dam and did not use piling.

Mr. STEVENS. Has any damage resulted?

Colonel GOETHALS. No, sir.

Mr. STEVENS. Was the accident which occurred at that dam caused by seepage through the dam?

Colonel GOETHALS. No, sir.

Mr. KNOWLAND. How long has that dam stood?

Colonel GOETHALS. Five or six years.

Mr. STEVENS. How deep is that upper stratum we have just been discussing?

Colonel GOETHALS. It varies from zero to a maximum depth of 80 feet.

Mr. STEVENS. Does it extend the whole length of the dam?

Colonel GOETHALS. No; it extends from the hillside at the spillway to the east bank of the Chagres, and then disappears entirely; on the west side of Spillway Hill it is found across the west diversion.

Mr. STEVENS. Does it extend the whole width of the dam?

Colonel GOETHALS. Yes; practically. There may be certain portions of the width where it does not appear.

Mr. STEVENS. Now, with that situation as a basis, what do you propose to do to construct the dam?

Colonel GOETHALS. Put in two rock piles, one on either toe, with 1,200 feet clear between them, and pump in selected material of sand and clay, the fill being made by what is known as the hydraulic process.

Mr. STEVENS. Where does this material come from?

Colonel GOETHALS. It comes from the Chagres River, about one-half mile and more below the dam.

Mr. STEVENS. In what way is it deposited in the dam?

Colonel GOETHALS. A suction dredge removes the material from the bank in which it is found and transmits it to the site through pipes. The material is then distributed by pipes or flumes over the area to be covered, the velocity of flow being regulated so that the heavy material—the sandy part—will settle near the toes, and the finer material settles in the vicinity of the sheet piling, making practically a core of clay.

Mr. STEVENS. What is the character of the material, what is the object of depositing it in that way, and what results are expected to be received from it?

Colonel GOETHALS. The material is a mixture of sand and clay; the object is to place the material uniformly over the area occupied by the dam, and to secure segregation of the clay in the portion of the dam under its highest part so as to make a practically impervious core in the middle.

Mr. STEVENS. With that situation, then—with an impervious lower base; with, as you state, a practically impervious upper base; with sheet piling through the upper stratum; with an impervious dam—do you consider the question of seepage eliminated?

Colonel GOETHALS. Yes, sir; and our experiments so indicate.

Mr. STEVENS. So then, the question you consider not open to fair and intelligent criticism or discussion?

Colonel GOETHALS. No, sir; it is not.

Mr. HUBBARD. You said your experiments had demonstrated that the question of seepage is eliminated. Will you please give us a full description of those experiments?

Colonel GOETHALS. In addition to the investigations of the substrata, two experimental dams were constructed for the purpose of testing the material that was available for use in building the dam, and also to determine the amount of seepage, if any, that we could reasonably anticipate. The first dam was constructed in such a way as to discharge the material upstream from the downstream toe, resulting in the settlement of the sandy portion of the material on the

downstream toe, and the clay portion on the upstream, but a large amount of the clay was carried off by the water. Water under pressure will seep through various materials, and, in this instance, the curve of saturation indicated a relatively small interference by the clay to the passage of water. It showed, however, that the material was such that in the width of the dam that is to be built, the seepage would be practically nil. In the second experiment, the material was spilled into the dam from both the up and down stream sides, and the discharged water regulated so as to deposit a greater portion of the fine material. This showed the practicability of obtaining a clay core by the hydraulic method, the material lending itself well to this end. The result of the experiment was a filtration very much less than was apparent in the first experiment, due to the fact that a greater mass of the silt was saved in the second instance than was possible in the first. The method of constructing the dam will follow that used in the second experimental dam, because of the better results obtainable.

Mr. HUBBARD. Will you explain what you mean by the "curve of saturation?"

Colonel GOETHALS. All materials offer a certain resistance to the transmission of water, sand, gravel, clay, each material through which water will percolate has its own coefficient of resistance to the transmission of water; and the curve shows the resistance that is offered by different materials, and the amount of saturation that the material will permit.

Mr. STEVENS. Now, with the question of seepage eliminated, we next come to the question of subsidence, or possibility of damage by change in base by reason of materials shifting their position.

Colonel GOETHALS. I do not anticipate any danger of that kind after the dam is completed.

Mr. STEVENS. Now, please indicate the nature of the base, and why you base your conclusion upon it?

Colonel GOETHALS. A great deal has been said about the blue clay that is found underlying this top stratum at various depths. This blue clay hardens and stiffens as the depth increases. The only difficulty I anticipate in the situation because of the clay, will be the slips that may occur during the construction of the rock toes, due to the sudden application of the mass which is heavy and suddenly applied from some height. If we had time and spread the material in relatively thin layers uniformly over the clay as it now stands, and over a sufficient area, the toes could be constructed without the least displacement and without any slips; but time is an element, the quantity of material practically unlimited, and nothing would be gained by such refinement in this instance. Moreover, to my mind, the material that slips out is replaced by better stuff, so that, in the end, a better construction results. In Boston, on Charles River, this method of distributing sand over an area of treacherous material resulted in securing such a distribution of the load as to enable the construction of a concrete wall, the weight of which did not disturb the underlying material.

Slip after slip occurred during the construction of the embankment for the relocation of the Panama Railroad at Gatun where the bottom is more treacherous than at the dam site. In this instance the base was gradually widened until sufficiently spread to transmit to the

underlying material less than the latter is capable of safely bearing. The embankment is satisfactorily completed, and is an example of the method to be followed in the construction of the Gatun dam. The safety of the south side of the toe where the slip occurred is due to the fact that the material there was spread out and the substructure on which it rests is not called upon to bear any greater weight than it can successfully withstand. This was not done on the north side where the slip occurred, and which would have saved the situation, for the simple reason that we did not care to take up any more of the space between the toes than is absolutely necessary. The selected dam material when in place will accomplish this purpose, and we prefer the material in that special part of the dam to the rock.

Mr. STEVENS. Then you have calculated the resistance to pressure and displacement that all of the strata in the base have, and have made your margin of safety come within it?

Colonel GOETHALS. Practically so, and we will determine it further by experience during construction, as in the case of the railroad fill.

Mr. STEVENS. Do you consider that the margin you will have is warranted by experience in this Charles River instance, and others that you know of?

Colonel GOETHALS. Yes, sir; and also our own experience in the construction of the relocated portion of the Panama Railroad on the Gatuncillo bottom.

Mr. STEVENS. Supposing that your calculations should miscarry, as they might—that the dam should subside through defect in the foundation at some point in the gorge—what would happen?

Colonel GOETHALS. Mr. Stevens, I am not ready to admit that. I do not think anything of that kind will occur after the dam is constructed to its full height.

Mr. STEVENS. You think that condition that I have just indicated will be eliminated by the construction of your dam?

Colonel GOETHALS. Yes, sir. When the dam is constructed, it will be there, and will stay there. We are going to have slips during construction until we get the load so distributed that the underlying material can bear it and remain in rest, and the conditions under which we are building it are of the most trying kind. We are putting in trestles 15 to 20 feet high and dumping from them carloads of rock in one spot, and after that has reached a state of equilibrium we are going to have no further trouble, and this can be reached and maintained by spreading out the rock pile. We have ample material to distribute that foundation over one-quarter to one-half mile without any difficulty whatever. So, I do not anticipate such trouble; I do not admit that there is weakness in the foundation.

Mr. STEVENS. Then, we understand we may consider the question of seepage eliminated, and that, also, we consider similarly that the question of slides will be eliminated by the precautions you have taken?

Colonel GOETHALS. We will not eliminate slides during construction, but I maintain that when the construction is finished we will not have slides, and I do not feel at all apprehensive about it.

Mr. STEVENS. Is the general plan you have just indicated the one that was received by you when you came here?

Colonel GOETHALS. Yes, sir.

Mr. STEVENS. And that the calculations which were made by the engineers previous to you have been substantiated by experience, and by the calculations you have made, incident to the continuance of the work?

Colonel GOETHALS. Not only substantiated, but the conditions are better, as shown by the result of our investigations than was believed to exist at the time they made their recommendations.

Mr. STEVENS. So, if you had been in their place, you would have adopted that plan?

Colonel GOETHALS. Yes, sir.

Mr. STEVENS. And as continuing your work, you would not change that plan?

Colonel GOETHALS. No, sir.

Mr. STEVENS. Now as to the locks—what is your investigation and experience as to the safety of the lock foundation and construction?

Colonel GOETHALS. There is no question in my mind but that we can build those locks and build them safe on the existing foundations.

Mr. STEVENS. What possibility of damage do you apprehend there may be in the lock floors by reason of a flow water getting to those floors through a seam?

Colonel GOETHALS. None whatever, because the lock floors will be drained and so constructed as to resist any head that is liable to come upon them; any pressure from that source, if the foundation is drained, must be local in its effect.

Mr. STEVENS. We understand from previous testimony that that head that may possibly come upon them can be calculated with exactness?

Colonel GOETHALS. It can—yes, sir; and we know the resisting power of the concrete, and we can so build our concrete floors as to resist any pressure that may be brought upon them.

Mr. STEVENS. So that we may consider that the question of damage or possible peril by water through seepage, seams, or otherwise through the lock foundation may be considered as eliminated?

Colonel GOETHALS. Yes, sir.

Mr. STEVENS. What do you know about possible seepage or flowage through seams in the hills which may imperil the possibility of the lake to be maintained?

Colonel GOETHALS. That question has been brought up, but the discussion is an academic one, entirely. A surveying party is out now making a careful survey and investigation of all the saddles bordering the lake. We do know there is a pond back of the railroad at Gatun on the relocated line which maintains its level; there is no seepage. We do know the Brazos Brook reservoir, with an area of 140 acres and depth of 34.5 feet, constructed in the hills near Mount Hope, has no appreciable leakage through the hills. We have another at Comacho, 38.4 acres in area and 55 feet deep, and we have another at Rio Grande of 72.9 acres and a maximum depth of 57 feet, with the cut relatively near. There is no leakage through the hills. I do not see any more reason to expect seepage from Gatun Lake through the hills than from these reservoirs.

Mr. STEVENS. Then no information has come to your office concerning the existence of any such caverns, gorges, or seams as would threaten the maintenance of that lake's level?

Colonel GOETHALS. Major Sibert reported the existence of certain limestone caverns east of San Pablo through which water percolated. The bulk of these caverns or broken rock formations, it was found, are above the 85-foot level of the lake, and therefore could not disturb the level of the lake, and that water from the caverns below the level of the lake flowed back into the Frijoles River, which is one of the rivers that will be submerged by the lake. There is no outlet there for water from the lake.

Mr. STEVENS. Then, so far as any information has come, the maintenance of the lake may be considered as fairly certain?

Colonel GOETHALS. So far as I know now. We are making investigations, and hope to conclude them by the end of this dry season. I have no apprehension on that ground, because of the conditions maintained by our reservoirs located in hills of the same geological formation.

Mr. STEVENS. When you first came to this work, who was division engineer in charge of the La Boca end of the locks?

Colonel GOETHALS. The organization has been changed entirely since I came here. There was no division engineer in charge of the La Boca locks. They had not been started; a trestle had been built preparatory to the construction of the Sosa-Corozal dam.

Mr. STEVENS. The point is this, Colonel: With whom originated the idea of changing the location of the Pacific locks?

Colonel GOETHALS. The first mention of the change was from Mr. John F. Stevens. Prior to the submission of the report of the board of consulting engineers to Congress, the board of national coast defense advocated a change for strategic reasons. Subsequently, the Culebra division found considerable difficulty in maintaining the dumps in the vicinity of Sosa-Corozal. The question was then discussed among ourselves whether we should resort to spreading the foundations sufficiently to bear the superimposed mass, whether we should excavate the material down to rock, or whether a change in plan had better be recommended. Major Sibert, who had charge of the department of locks and dams, had supervision over the surveys and borings for securing the necessary data and for preparing estimates, and later submitted a report recommending the change.

Mr. STEVENS. Upon consultation of the various engineers in charge having the responsibility for that work, it was finally concluded to report in favor of a change in location of the Pacific locks.

Colonel GOETHALS. Yes, sir; that was done by action of the commission; the commission has charge of all general plans.

Mr. STEVENS. And that was approved by the commission?

Colonel GOETHALS. That was recommended by the commission to the Secretary of War, and it was approved by him and by the President. The Secretary of War, in transmitting report of the board of consulting engineers, calls attention to the fact that, for military reasons, the location of those locks seemed objectionable, and it might be desirable to withdraw them. I was connected with the board of national coast defense at the time and we reported that it was an unsuitable location from a military standpoint.

Mr. STEVENS. Now, have any reports come to you as chief engineer or chairman, from any of the engineers connected with the Gatun dam or locks, calling attention to grave or perilous defects which

would lead you to conclude that a similar change could be made to advantage at Gatun?

Colonel GOETHALS. No, sir.

Mr. STEVENS. From your experience as an officer of the Corps of Engineers, what would you conceive to be your duty if a defect, grave or perilous, were discovered in any way in connection with any of the locks or dams on the Pacific or the Atlantic side?

Colonel GOETHALS. I conceive that my duty would be to report fully to the Secretary of War, with recommendations.

Mr. STEVENS. As you did in the case—

Colonel GOETHALS. Of the Pacific locks.

Mr. STEVENS. Has any such defect or condition been brought to your attention which would require any such report as to the Gatun locks or dam?

Colonel GOETHALS. Not from the Isthmus. I received a letter from the President asking for my views, and I unhesitatingly gave them—that the present project is practicable and safe.

Mr. STEVENS. As you have given this committee?

Colonel GOETHALS. Yes, sir.

Mr. BARTLETT. I would like you to state what opinion you draw from the Gatun slide—what it indicates, especially as to the foundations there at the bottom of the old French canal—just as you explained it while we were on the ground?

Colonel GOETHALS. The slip that recently occurred on the south toe of the dam is the fifth one of the kind that has occurred. Except for the fact that a flood in the Chagres River existed at the time of the slip, it would probably have caused no more comment than the four of its predecessors. It was probably due to the fact that the water in the French canal had been pumped out to a depth 10 feet below sea level, changing previous conditions which were necessary for equilibrium. The weight of the superstructure was so great as to force down and out certain soft materials under the rock fill, which material had not been removed prior to the construction of the rock pile. The settling reached a point when the slipping northward was more easy than further penetration downward, and as a consequence the rock was forced downstream and carried up with it the clay and silt from the bottom of the old French canal. But for the fact that we did not care to encroach on the 1,200 feet that we are reserving for selected material, a condition of equilibrium would have been maintained there by spreading out the foundation on the north side of that fill, as is done on the south side; but, from an engineering standpoint, it is of no importance, any more than a slip on a railroad embankment is of great importance during the construction of a railroad. Will that answer your question, Mr. Bartlett?

Mr. BARTLETT. Yes, sir. The water in the canal had also been drawn out?

Colonel GOETHALS. Yes; so we did not have the pressure of the water there to resist that tendency to slip.

Mr. BARTLETT. Was there any indication at all of slipping on the south side?

Colonel GOETHALS. No; the south side remained intact. We are going to have those slips when we cross the French diversion, and those slips are going to be greater than they are in this French canal,

and they are going to be greater on the north toe of the dam crossing the diversion than on the south toe where it crosses the north diversion, unless we take special precautions to prevent them.

Mr. BARTLETT. Now, that last slip; did it affect the dam at all?

Colonel GOETHALS. It does not affect the dam in any way.

Mr. RICHARDSON. It is practically agreed, is it not, that there are three problems connected with the construction of this canal. One is sanitation, the other is housing and feeding the employees, and the third is the character of the canal?

Colonel GOETHALS. Yes, sir; those are settled.

Mr. RICHARDSON. And your reference to the public clamor. You admit, do you not, or is it not a fact that the public disquietude relates only to the foundation of the Gatun dam?

Colonel GOETHALS. I presume so, from the press accounts.

Mr. RICHARDSON. All other questions and considerations in the construction of the canal are secondary to that one question?

Colonel GOETHALS. Yes, sir.

Mr. RICHARDSON. And I am fully satisfied that you are ready, willing, and prepared to give all the information that is within your power—

Colonel GOETHALS. We have given it; nearly two-thirds of that annual report is devoted to a discussion of the dam, and all the information we have is recorded there, in Mr. Saville's report, in such a manner as we thought would make it clear to the layman.

Mr. RICHARDSON. And I understand you to state that by reason of this public clamor and disquietude in the public mind that you have adopted precautions that you deem unnecessary for the maintenance of a solid and safe foundation at that dam, and that it adds more expense?

Colonel GOETHALS. Yes, sir; it adds more expense. If I were building this dam in the States, I would not put in sheet piling. I would not go to the expense of putting in such floors in the locks as we intend to do in order to make them additionally secure. There was the same clamor, only to a lesser degree, in your district against the Colbert Shoals lock when I was connected with that work.

Mr. RICHARDSON. Now, if I understand you correctly, Colonel, it is that the pit test as well as the borings that you made brought forth the ascertainment of the fact that there was loose sand mixed with clay on the surface of that ground for some 80 feet below?

Colonel GOETHALS. It is a stratum varying in thickness, the maximum being 80 feet.

Mr. RICHARDSON. If I understand further, you then struck blue clay running down probably 100 feet?

Colonel GOETHALS. We have struck various materials, as indicated in the diagram—clay, gravel and clay, sand and clay, and clay mixed with shells; but as a rule it is all clay below that top stratum of sand and clay.

Mr. RICHARDSON. Now, below that blue clay that you say is impervious to water—

Colonel GOETHALS. Yes, sir—

Mr. RICHARDSON. Thirty feet below that, if I remember, you found gravel and bowlders?

Colonel GOETHALS. No bowlders and no gravel by itself. That is, where our investigations show that the conditions existing to-day

are better than was supposed to exist at the time of the consulting board's report. The borings made at that time were made hastily; they were all wash borings. They were made by putting down a pipe, and by hydraulic jet forcing the material out within the inclosure of the pipe. The material was gathered as it came up with the water, and the material found at various depths was so determined. These washings came out showing gravel. When we made our borings we had more time. We made the wash borings, but also took drive or dry samples, which gave us a correct record of the material as to depth and as it is in place. We found that gravel thoroughly cemented with clay. We have photographs showing the gravel as it comes out by the wash borings and that same material as it comes out in the drive samples. That material is cemented together, and we could core it and stand it on end.

Mr. RICHARDSON. You did not find any boulders or rock?

Colonel GOETHALS. None, except the rock foundation at the bottom of the gorges.

Mr. RICHARDSON. It is undoubtedly true, is it not, from an engineering standpoint, that a rock foundation would give you more satisfaction than any other kind?

Colonel GOETHALS. I have never been of that opinion, for I have great faith in earth dams. We have 14 miles of earth dam on the Muscle Shoals Canal. They never thought of putting in masonry there, though they had rock foundation.

Mr. RICHARDSON. You are not prepared, then, to say from an engineering standpoint that a rock foundation there would be at all superior to the one you have?

Colonel GOETHALS. Not in my opinion, for I have faith in earth dams.

Mr. RICHARDSON. Now, as an engineer, you are aware of the fact that prehistoric volcanic convulsions have taken place there?

Colonel GOETHALS. I am.

Mr. RICHARDSON. Well, do you believe that these convulsions that have taken place in the history of the world at some other time are calculated to disturb the level of that lake by seepage?

Colonel GOETHALS. I have given the reasons which lead me to believe that such criticisms and rumors about seepage from the lake are not founded on fact—I believe there is nothing to be apprehended from that, because our reservoirs constructed in practically the same formation maintain their levels.

Mr. RICHARDSON. You admit, though, Colonel, do you not, as an engineer, that such convulsions as that are calculated to leave breaches and crevices not perceptible to the human eye?

Colonel GOETHALS. Yes; and I believe that if such exist we will discover them during construction and as the lake rises.

Mr. RICHARDSON. Is that not the very point upon which Major Sibert and yourself differ?

Colonel GOETHALS. No. We have no difference of opinion on that point. Major Sibert says, in effect, that the seepage of the lake through the hills is an unknown quantity, and so do I, but from the maintenance of reservoirs in the same character of formation as the sides of the lake I do not apprehend any difficulties on this score. Major Sibert has submitted a plan for lock floors about which he is apprehensive. The matter is not settled, as I appointed a board to

study the matter and to report the results of its studies. The board has not met as yet for its discussion, so the matter is not settled. Following engineering practice, the water in the foundations should be drained therefrom, and if this be done the only danger will be from leaks through seams, and if the concrete lock floor is connected with the foundation—as it must be—the upward pressure from leakage through seams in the rock must be local and can not be exerted over the entire lock floor. As an engineer, I am willing to take some risks, desiring to be safe with due regard to economy. I am willing to risk something, for even if we take all safeguards we can not be sure of everything.

Mr. BARTLETT. You are not sure that the sun will rise in the morning?

Colonel GOETHALS. No, sir.

Mr. RICHARDSON. I am going to ask you a question or two, which, if you do not care to, you need not answer.

Colonel GOETHALS. I will answer anything, Judge, that I can.

Mr. RICHARDSON. The public has been advised that the President-elect is coming here with several expert engineers. Have you been notified, officially, of any cause of complaint that brings them here?

Colonel GOETHALS. No, sir.

Mr. RICHARDSON. As to your plans?

Colonel GOETHALS. No, sir.

Mr. RICHARDSON. Have you been notified that they are coming?

Colonel GOETHALS. I have heard that the President-elect and engineers were coming down, but I have not been advised as to their names or duties.

Mr. RICHARDSON. You have not been advised at all?

Colonel GOETHALS. Not officially; you see the appointment of the board was made only a few days ago, and I presume the President will give them instructions. From the newspapers I see they are coming down to look into the construction of the Gatun dam.

Mr. RICHARDSON. Now, the change you say you suggested in reference to the locks on the Pacific side was induced on your part from military necessity?

Colonel GOETHALS. Military reasons—yes, sir.

Mr. RICHARDSON. You apprehended, then, that those dams could be bombarded?

Colonel GOETHALS. No, sir; I had no doubt about the dams; you can not get a shell through masses of earth like those; what I apprehended was bombardment of the locks which were to project into the Pacific.

Mr. RICHARDSON. By a foreign enemy?

Colonel GOETHALS. Yes, sir.

Mr. RICHARDSON. That would necessarily imperil the canal?

Colonel GOETHALS. Yes, sir. The canal should be fortified, and I think the time is ripe now for the commencement of those fortifications.

Mr. ESCH. Because the material is now available?

Colonel GOETHALS. Yes, sir; and because those defenses should be completed by the time the canal is completed.

Mr. RICHARDSON. When you came down, Colonel, in 1907, who came with you as engineer?

Colonel GOETHALS. Major Gaillard.

Mr. RICHARDSON. Major Sibert came after?

Colonel GOETHALS. He came after—a week or ten days later.

Mr. RICHARDSON. Do you fully and freely consult with your associates?

Colonel GOETHALS. Always—not only with the division engineers, but lower down. I will consult a foreman about his particular class of work. It helps the foreman and it helps me.

Mr. RICHARDSON. Now, you spoke of the slip that took place on the south toe of the Gatun dam, and stated that you fully expected to have slips at other places. Do you mean at other places outside of Gatun?

Colonel GOETHALS. I mean at other places on the line of the Gatun dam, where the rock toes cross the French canal and the west diversion. Those slips will continue during construction unless we resort to a more expensive method, both as to time and money for constructing them, which I do not think the situation warrants.

Mr. RICHARDSON. In the event you did not have these succeeding slips, how would that affect your convictions about the slips that have already taken place?

Colonel GOETHALS. It would not affect them.

Mr. RICHARDSON. Now, you are president of the Panama railroad?

Colonel GOETHALS. Yes, sir.

Mr. RICHARDSON. The Government owns the Panama Railroad?

Colonel GOETHALS. Yes sir; but it is operated as a corporation under its old charter granted under the laws of the State of New York.

Mr. RICHARDSON. Are there any individual stockholders in the Panama Railroad?

Colonel GOETHALS. Yes, sir; I am a stockholder.

Mr. RICHARDSON. Is Mr. Cromwell a stockholder?

Colonel GOETHALS. No, sir. So far as I know the only stockholders are the Secretary of War and the board of directors. Each of the latter owns one share of stock which is immediately assigned back to the Secretary of War after \$90 have been paid for it.

Mr. RICHARDSON. I am asking you these questions, Colonel, because I have heard some complaint. I am satisfied you can clear it all up.

Colonel GOETHALS. I do not think Mr. Cromwell owns a share of stock. The Secretary of War could advise you on that point definitely.

Mr. RICHARDSON. And the Pacific Steamship Line that is engaged in the transportation of supplies from the United States to the Isthmus; you know of none of the owners of that line that are interested in the Panama Railroad Steamship Line?

Colonel GOETHALS. No, sir; the Panama Railroad Steamship Line is owned by the Panama Railroad Company.

Mr. RICHARDSON. Are there any individual owners outside?

Colonel GOETHALS. I think the question of stock ownership governing one would refer to both. This method of handling the railroad and steamship line is necessary in order to enable it to do commercial business and to live up to the requirements of its concession from the Colombian Government.

Mr. RICHARDSON. You are familiar with all the borings that have taken place on the Gatun dam?

Colonel GOETHALS. Yes, sir.

Mr. RICHARDSON. How far have you gone down?

Colonel GOETHALS. Down to rock—in the vicinity of 260 or 270 feet below sea level.

Mr. RICHARDSON. Do you recall the depth to which De Lesseps went down?

Colonel GOETHALS. I do not think they ever went over that site. That site was proposed by a French engineer at one time, but they selected a site at Bohio.

Mr. RICHARDSON. What other borings previous to yours were made, by whom, and to what depth?

Colonel GOETHALS. Wash borings only were made to the depth of rock by parties under Mr. Stevens, then chief engineer, for the information of the board of consulting engineers.

Mr. RICHARDSON. As to whether they could find a safe location?

Colonel GOETHALS. As to the character of material in the area over which the dam was to be constructed.

Mr. RICHARDSON. Did you find any difference in the material that you developed on your borings from the borings made under Mr. Stevens or under Mr. Wallace?

Colonel GOETHALS. No; we found no difference so far as their classification of materials went; but we found it in place, in a different condition than was reported, for the simple reason that they were being constantly pressed for this information to furnish the consulting board, sitting in Washington; and when I was here in November, 1905, they were cabling up the information as they got it from the Pacific side. They did not have the time to investigate the situation as we have since—that is all.

Mr. RICHARDSON. By whom were they spurred on?

Colonel GOETHALS. They were being spurred on, I presume, by the desire to get the type of canal definitely settled, so that work might progress along proper and definite lines, and probably by the desire of the members of the board to get back to their own work.

Mr. RICHARDSON. When they ought to have taken more time?

Colonel GOETHALS. No; I do not say that. I do not mean to criticize anybody; I do not know what the conditions were. I do know, when I was here, in November, 1905, I was told that prompt information concerning the substructure on which this superstructure was to be located was desired. We have found gravel where they reported gravel, but we have found that gravel imbedded with clay so as to make an impervious material. That is just the difference.

Mr. ESCH. You have referred to the Wachusett dam in Massachusetts as being a model for the Gatun dam and that it was an earthen dam. That Wachusett dam was not constructed by the hydraulic process, as I understand it?

Colonel GOETHALS. No; part of it was rolled.

Mr. ESCH. What do you mean by "rolled?"

Colonel GOETHALS. They distributed layers of material and then drove teams with suitable appliances over for compacting it.

Mr. ESCH. Would you consider an earthen dam made by the hydraulic process more compact and more secure than one made by the "rolled" process?

Colonel GOETHALS. Yes; because you get a more uniform distribution of pressure during construction than is possible by rolling.

Mr. ESCH. Could you, by the "rolling" process, distribute the silt or finer clay in a given portion of such dam?

Colonel GOETHALS. No; not as satisfactorily or as well; we could not do it, in fact.

Mr. ESCH. Then you can do that by the hydraulic process?

Colonel GOETHALS. Yes, sir.

Mr. ESCH. Therefore the Gatun dam will be more safe than the Wachusetts dam?

Colonel GOETHALS. Under the same conditions it would be safer than the Wachusetts dam, but we are so far superior in dimensions, we are way beyond the Wachusetts dam in safety. I think this dam at least ten times better and stronger than the Wachusetts dam.

Mr. ESCH. Now, there was a big slide in the Wachusetts dam some two or three years ago. What was the material deposited at the foot of the Wachusetts dam outside of the earthen core on the water side? Was it not gravel?

Colonel GOETHALS. Some gravel, as you approached the water surface.

Mr. ESCH. Was not the slide due largely to the character of the material they used in their toe?

Colonel GOETHALS. That is a disputed question; there was no toe as we have. I gathered from Mr. Stearns that a small bank of muck was left under the dam where the slip occurred, and which he said should have been removed. In addition, the mass next to the water became water-soaked and slipped until the angle of repose was reached. The slip was local, and at no time did it threaten the safety of the structure. We obviate such a contingency by putting in a rock pile on either toe for weight, and by decreasing the slopes.

Mr. ESCH. So that the Wachusetts dam can not be taken as an example of what might happen at the Gatun dam?

Colonel GOETHALS. No, sir; we are safe when equilibrium is established.

Mr. ESCH. I noticed you had a hydraulic dredge, I should judge, less than a quarter of a mile north of the north toe of the dam, pumping in this silt—

Colonel GOETHALS. That is 2,200 feet from the north toe of the dam, if I understood Major Sibert correctly.

Mr. ESCH. Now, then, to fill up that dam a vast amount of material will be required. Have you sufficient material available?

Colonel GOETHALS. We estimate that 18,000,000 cubic yards of selected material will be required for the dam, and within reasonable reach we have 22,000,000 cubic yards.

Mr. ESCH. How much do you contemplate taking out north of the dam?

Colonel GOETHALS. About 18,000,000 yards, unless we find it more advantageous to put in a dredge on the upstream side of the dam.

Mr. ESCH. That would all be taken out at what farthest distance from the north toe?

Colonel GOETHALS. The general plans provide a berm of the natural surface of the ground for a distance of 1,500 feet below the dam. The selected material is then removed so as to leave a slope of 1 vertical to 10 horizontal, and until a depth of 40 feet, approximately, is reached, and this material is removed to this depth and to the north.

Mr. ESCH. Would the taking out of 18,000,000 cubic yards of silt in the valley of the Chagres within a mile and one-half of the north toe destroy the equilibrium of the dam?

Colonel GOETHALS. No; the material and the general design are such as not to cause any bad effect.

Mr. ESCH. The silt would be supplanted by water?

Colonel GOETHALS. Yes.

Mr. ESCH. Had you any experts on underground water and underground flow examine the Gatun site?

Colonel GOETHALS. Mr. Saville, assistant engineer, is a man who had been with Mr. Stearns on the Wachusett dam, and with Mr. Freeman, who is an expert on such subjects. Major Sibert secured his services after some correspondence with both Mr. Stearns and Mr. Freeman, and Mr. Saville made the investigations of the Gatun dam foundations.

Mr. ESCH. You have never consulted Professor Schlichter on underground water and flow?

Colonel GOETHALS. No, sir.

Mr. ESCH. I notice he is referred to in this annual report.

Colonel GOETHALS. We have made use of the information in his books.

Mr. ESCH. You feel satisfied you have made all the examination necessary as to underground flow?

Colonel GOETHALS. All that is necessary and all that is possible.

Mr. ESCH. In that connection, Colonel, I noticed in the spillway and in the lock sites that the dip of stratification was to the north. That would lead us to believe that this stratification would be down underneath the surface of the lake, south of the dam?

Colonel GOETHALS. Yes, sir.

Mr. ESCH. This is a rough cross section [exhibits pencil sketch]. This represents the lock section; this represents the dip of stratification. These gorges would doubtless go down and cut through these stratifications below the lake surface. Would it be possible for the water to percolate down through and reach these stratifications and come out underneath the lower lock?

Colonel GOETHALS. The excavation for the locks cuts through a hill; just to the south of the hill the rock is some distance below the surface, so that water would have to percolate through a considerable depth of material before it could reach the stratification, and must then run downhill against an ever-increasing head from the sea. Water is innocent and has no ulterior motives.

Mr. ESCH. Do you anticipate any trouble from slides anywhere within the cut hereafter?

Colonel GOETHALS. No. I have always thought and I still think that whatever large slides may be met with will occur during construction, and that when the canal is completed our sliding question will be practically eliminated.

Mr. ESCH. A lake 164 square miles in area will admit in this climate of enormous evaporation?

Colonel GOETHALS. Yes, sir.

Mr. ESCH. You have determined the exact amount?

Colonel GOETHALS. We are still conducting experiments to determine it. Evaporation tests have been made on an elevation higher

than the lake level, and we are now trying to get tests closer to what the normal conditions will be.

Mr. ESCH. The French made tests?

Colonel GOETHALS. Yes, sir.

Mr. ESCH. With that degree of evaporation and with the allowance for seepage—of which you admit there will be some—will there be a sufficient water supply from the Chagres and its tributaries to meet the needs of navigation?

Colonel GOETHALS. Yes, sir; I think so.

Mr. ESCH. Will you not put a limit on the number of lockages per day?

Colonel GOETHALS. That is a physical condition that limits itself.

Mr. ESCH. But how many lockages can you make per day?

Colonel GOETHALS. We figure 48 will be the maximum, assuming an hour per vessel in passage.

Mr. ESCH. With that maximum continued through three hundred and sixty-five days, will you maintain a level sufficient to carry through vessels of a draft of 30 feet?

Colonel GOETHALS. I think so. You see, we do not have to figure on three hundred and sixty-five days; we have only to figure, practically, on the dry months. We have a surplus during the rainy season, so that our water supply must be sufficient to carry us through the dry season only; and that water supply, as figured on by the board of consulting engineers, is a difference of 5 feet in the level of the lake—87 to 82 feet.

Mr. ESCH. You could with little expense raise the level of the lake 2 or 3 feet?

Colonel GOETHALS. We can.

Mr. ESCH. Do you think there is any immediate necessity of constructing a reservoir at Alhajuela?

Colonel GOETHALS. I think there was a time when there was absolute necessity for it, but that necessity has to some extent passed.

Mr. ESCH. That necessity was what?

Colonel GOETHALS. For power. I think if we had put a dam there at first we would have had all the power necessary to supply the Isthmus for years.

Mr. ESCH. With that power what would you operate?

Colonel GOETHALS. The lock gates, the valves, the Panama Railroad; and we could have lighted the entire Isthmus and the canal. I was in favor of that one year ago.

Mr. ESCH. You could not have operated dredges and shovels with that power?

Colonel GOETHALS. No; but that is relatively a small matter. Now we are going to build an electric plant at Gatun for construction purposes and use it for lighting purposes also, and one at Miraflores for the same purposes, and eventually the former will be on the spillway and furnish power and light for the canal, the plant at Miraflores being a reserve. If we had constructed a dam at Alhajuela we would have had abundant power for all purposes.

Mr. ESCH. Could you have used electric drills?

Colonel GOETHALS. We could, and I think more economically than air, now being used.

Mr. ESCH. Do you think there is still advisability of constructing a power dam at Alhajuela?

Colonel GOETHALS. I would still be in favor of it.

Mr. ESCH. At an estimated cost of?

Colonel GOETHALS. The estimated cost of the dam contemplated is \$3,100,000. It could be constructed so as to give an additional storage basin and at the same time be capable of developing from 15,000 to 18,000 horsepower.

Mr. ESCH. How far is that from Bohio?

Colonel GOETHALS. About 10 miles from Gamboa; 8 miles by land, 11 miles by river.

Mr. ESCH. What would be the capacity in cubic feet of the dam at Alhajuela, as near as you can estimate?

Colonel GOETHALS. We estimated on a concrete dam. We have there a narrow gorge with rocky cliffs on either side of the river and a rock bottom. We could make the fall anything we please, practically, and get all the power we want, and with our power there instead of at the Gatun dam the water discharged from that pool would replace the water that would evaporate from Gatun Lake and we would not be using water from the lake. We would be freed for all time from any coal charges in the operation of the canal, which is not now the case.

Mr. ESCH. Then, from all view points, that would be a very desirable thing to construct now?

Colonel GOETHALS. I think so; but what I am anxious, in the construction line, to do is to avoid the purchase of any more plant. Just now, with the increase incident to widening the cut section, we will be pretty well occupied for another year, and I would rather defer the Alhajuela matter for that length of time rather than take it up just now, especially as we are arranging for power plants at Gatun and Miraflores. If we could have done it a year ago it would have resulted in considerable economy.

Mr. HUBBARD. I will ask you to explain how, by this hydraulic process, you are enabled to place the fine clay in the position where you want it to form a core for the dam?

Colonel GOETHALS. The whole question depends upon the carrying capacity of water under varying velocities. Streams having certain velocities will carry gravel and boulders. As that velocity is reduced the next larger particles are deposited, and finally, when the flow is reduced to a minimum, or practically stopped, the fine silt settles, furnishing, in the low places, the "mud spots."

Mr. HUBBARD. You can make that low place or "mud spot" wherever you please?

Colonel GOETHALS. Yes; and deposit the fine material as you please by regulating the velocity of discharge.

Mr. HUBBARD. You have faith in the earth dam?

Colonel GOETHALS. Yes, sir.

Mr. HUBBARD. And in an earth foundation and toes for it?

Colonel GOETHALS. Yes, sir.

Mr. HUBBARD. How about that compared with a rock foundation, in your judgment?

Colonel GOETHALS. I would not be satisfied with an earth dam the material of which is placed directly on rock, but would desire a masonry core to make a bond between the earth superstructure and the rock foundation. With this modification I am satisfied with either, or with any character of dam that is properly constructed and will do

the work intended or required. I have seen masonry dams which leaked, and in such a way that they are difficult to repair. I have heard of masonry dams failing in much the same way that earth dams fail, but I do know that the leakage through an earth dam can be repaired if its location can be determined and the velocity is not too great.

Mr. HUBBARD. The earth dam may form a better bond with earth than earth with rock.

Colonel GOETHALS. Yes, sir. At the Wachusetts site there is a stone dam in connection with the so-called dikes on either side, and that stone dam showed indications of leaks when I was there. I spent five years stopping leaks in poorly constructed earth dams on the Tennessee River, and I know such repairs can be made.

Mr. HUBBARD. You said something of widening the $4\frac{1}{2}$ -mile part of the Culebra cut. When and how was that directed?

Colonel GOETHALS. It was authorized by the President of the United States.

Mr. HUBBARD. Has an estimate of expense been made?

Colonel GOETHALS. Yes, sir; practically \$13,000,000.

Mr. HUBBARD. And what will the width be when that addition is made?

Colonel GOETHALS. The width for the $4\frac{1}{2}$ -mile stretch, from Las Cascadas to Paraiso, was fixed at 200 feet. The widening of that section to 300 feet has been authorized.

Mr. ESCH. The New French Canal Company planned to build the dam at Bohio?

Colonel GOETHALS. Yes, sir.

Mr. ESCH. They had in mind also possible construction at Gatun?

Colonel GOETHALS. I do not understand it that way. As I understand the situation, the plan for the dam at Bohio had already been submitted and adopted; and subsequently a French engineer visited this country and advocated a change in the site from Bohio to Gatun. I may be wrong as to these relative times, but I know a dam at Gatun was at one time proposed.

Mr. ESCH. Could you state briefly the advantages of Gatun over Bohio, so far as the foundations are concerned?

Colonel GOETHALS. The site at Gatun is superior. The Chagres River brings down large quantities of gravel, and these gravel banks extend all the way down to the vicinity of Bohio, where, striking sea level, the gravel is deposited from there on up. At Bohio, at the time investigations were made for report of the consulting board, nothing but gravel deposits were found above the rock. The gorge in the river is practically the same as that at Gatun; the depth is somewhat less, but approximately the same. So that in the construction of a dam at Bohio it would be absolutely essential that the flow of water through the gravel be cut off. We have no such flow at Gatun. The dam at Bohio would have necessitated another dam up the Chagres River to control the Chagres floods. Those are, briefly, the reasons why the Gatun site is preferable to that at Bohio.

Mr. KENNEDY. If the evaporation should prove to be much greater than you have anticipated—which I presume it will not—that would entail only the lowering of the cut through the mountain to correct your whole project and make the scheme operative?

Colonel GOETHALS. The scheme would be operative. Instead of having 45 feet of water in the cut we would have whatever depth it would be reduced to by reason of evaporation.

Mr. KENNEDY. Any failure of water in the lake would only prevent very large ships from passing—smaller ones would be able to pass?

Colonel GOETHALS. It would reduce the navigable depth only.

Mr. STEVENS. If leaks should occur in the upper portion of the dam, or anything might occur in the settling of materials so a small stream would run over the top, have you means at hand to make repairs?

Colonel GOETHALS. The repairs could be made.

Mr. STEVENS. Have you taken that into consideration?

Colonel GOETHALS. No, sir; because we do not anticipate any such leak, as the dam is 500 feet through at the surface of the water, where the pressure is zero.

Mr. STEVENS. So you consider the matter is beyond question?

Colonel GOETHALS. Yes, sir.

Mr. STEVENS. In the construction of locks, have you had any experience, or do you know of any accidents to locks constructed in flights, by vessels plunging through them?

Colonel GOETHALS. No, sir.

Mr. STEVENS. Have you considered that there was any element of danger that you have not met or considered in constructing locks in that way?

Colonel GOETHALS. No, sir. Personally, I would prefer the separation of the locks rather than building them in flights, but that is merely a question of design and not of safety.

Mr. STEVENS. Is there any construction of locks, or concrete construction, in the United States, that approaches the size constructed by the Engineer Corps of the Army?

Colonel GOETHALS. No, sir.

Mr. STEVENS. Are there any engineers in private practice in the United States who have the experience in such construction of the engineers of the army?

Colonel GOETHALS. Yes, sir; but they acquired their experience on river and harbor works. Recently, the New York Barge Canal has developed a field for lock construction.

Mr. STEVENS. Does that approach in size the locks contemplated for this canal, or other work the army engineers have been accustomed to construct for some time past?

Colonel GOETHALS. No, sir. There is nothing difficult in the construction or design. It is simply an application of well-known principles.

Mr. STEVENS. What engineer of the army has had the most experience and the greatest opportunity to know about the construction and operation of such large locks?

Colonel GOETHALS. Colonel Hodges, I believe, is considered as practically the expert of the engineer department in lock and lock-gate design and construction.

Mr. STEVENS. So you have the best man in the United States, so far as experience and ability are concerned, for that purpose?

Colonel GOETHALS. Yes, sir; that is my opinion, and was also the expressed opinion of General Mackenzie, Chief of Engineers, when I came here, and when I tried to secure his detail for the work he is now

doing. His text-book on lock gates is practically an authority to-day; and his value comes from the fact that he has himself figured out the strains and planned the design of the Poe lock gates, which have been in successful operation, and were, at the time of their construction, the largest built.

Mr. STEVENS. Is it, or not, an advantage to the general engineering features and execution of this work, to be in haste in your work of explorations, calculations, and experiments, for the completion of the locks and dams?

Colonel GOETHALS. No; we ought not to be too hasty.

Mr. STEVENS. You ought to take sufficient time, irrespective of what popular clamor may be, to do this work as it ought to be done?

Colonel GOETHALS. Yes, sir.

Mr. STEVENS. I certainly hope you will take it.

Mr. RICHARDSON. In your administration you lay out work for your division engineers?

Colonel GOETHALS. No, sir. In the organization in effect now I have endeavored to fix responsibility on everybody, from the top on down. The general design of the locks was prepared in the main office; those plans were sent to the division engineers and they were requested to criticise them—in fact, I had a board of engineers to pass on the studies submitted before I approved them. Stenographic reports were kept of the proceedings of that board. After going through that, I finally approved the general plans as they now stand. Those general plans were sent then to the division engineers to fit them to the ground—to the site. Then they submit those to me, and my final approval is necessary. My approval is necessary for all work that originates with the division engineers.

Mr. RICHARDSON. You can either approve or disapprove them?

Colonel GOETHALS. Yes, sir.

Mr. RICHARDSON. Among the visiting consulting engineers that are to come here, has any one of them, to your knowledge, been over this work at all?

Colonel GOETHALS. Yes, sir; Mr. Stearns and Mr. Randolph were on the board of consulting engineers in the first instance. Mr. Stearns and Mr. Freeman were on a board appointed by the President in April, 1907, to pass upon the rock forming the foundation of the Gatun locks. The others have not been here that I know of.

Mr. RICHARDSON. How many are there?

Colonel GOETHALS. From the press I see there are six.

Mr. RICHARDSON. Do you know who advised the selection of those men?

Colonel GOETHALS. No, sir; I know nothing about that.

Mr. KNOWLAND. Yesterday, during the discussion, the fact was brought out that there was some question relative to the present height of the Gatun dam. Have you considered that matter at all?

Colonel GOETHALS. That question is being drawn up by the division engineer of the Atlantic division, and has not yet reached me; but in a discussion with him I told him I favored it; that is, reducing the height to 105 feet above sea level, in place of 135 feet. The plan has not as yet reached me.

Mr. KNOWLAND. You consider that just as safe?

Colonel GOETHALS. Yes, sir. We get the same dimensions of the dam, so far as the water pressure is concerned, and we get a more uniformly distributed load over the foundations. The reason for

giving the dam the 135-foot height by the minority of the board of consulting engineers was, that by that additional weight the material below would be compressed more. But the material is not a deposit of silty material as supposed; so there is no necessity for that additional height, and as the locks are practically 90 feet high, and as just back of Gatun village there is a saddle only 91 or 92 feet high, there is no object in making the dam higher, because the water would spill over the locks or the saddle.

Mr. ESCH. What recommendations have you to make to the committee with reference to the administration of lands within the zone?

Colonel GOETHALS. I think the time has come when we ought to be allowed to give longer leaseholds. We know definitely what lands can be leased, and we ought to encourage settlement of the zone.

Mr. ESCH. To that end, would you extend the period, and if so, to what length?

Colonel GOETHALS. I do not know what rights the Government would have in reference to selling lands, but I would be in favor of actually selling the land.

Mr. ESCH. Would you limit the amount of the holding?

Colonel GOETHALS. Yes, sir; so as to avoid the land getting into the hands of a trust.

Mr. ESCH. Then you would make them nontransferable?

Colonel GOETHALS. In the case of leasehold; yes, sir.

Mr. ESCH. Would you require any particular qualifications for a tenant?

Colonel GOETHALS. I have not considered the matter; I do not know that I would. I believe in the rapid settlement of the zone.

Mr. ESCH. Are there any difficulties in giving new lands to the people owning land to be submerged by the Gatun Lake?

Colonel GOETHALS. I do not see that there is, provided the land that the United States has in its control is ample.

Mr. ESCH. That has not been determined?

Colonel GOETHALS. I do not know. Mr. Rogers recommended it, so I assume the office engineer told him there was sufficient land for that purpose.

Mr. ESCH. Colonel, you have had a remarkably fine record on the zone as to casualties; but you had a serious accident about a month ago at Bas Obispo. Have you determined the cause for that premature blast?

Colonel GOETHALS. No; and we will not be prepared to do so until we get a chemical analysis. The first impression we got was that the explosion occurred due to the loading of the last hole; but we are pretty well convinced now that that is not so. The electric current was in no way connected. It was supposed by some it might have occurred by induction when the current was turned on. That was not so, because the explosion occurred prior to the turning on of the current. We found it could not have happened by induction, anyway. But in making an examination to find whether an induced current through a fuse from a wire lying near could have been the cause, we found that the water had a certain amount of acidity, and it is possible that acid attacked the cartridge, liberating the glycerin which is very sensitive to jar, and that a dokey shot fired in the vicinity just prior to this explosion may have caused the explosion.

Mr. ESCH. Each charge is connected by a wire to a central point?
Colonel GOETHALS. Yes, sir. [Explains by a diagram how charges are connected.] But in this case the charges were not connected.

Mr. ESCH. You have a wireless station at Gatun?

Colonel GOETHALS. No; we have one at Colon, maintained by the Navy Department.

Mr. ESCH. I meant at Colon. What is the power developed there—the voltage?

Colonel GOETHALS. I do not remember.

Mr. ESCH. I understand it is 40,000 volts.

Colonel GOETHALS. It may be, as they communicate with Key West.

Mr. ESCH. We have a wireless connection on each of the Panama Railroad ships. This accident occurred six minutes after 11 o'clock. Have you ever thought to examine whether a wireless message was received or transmitted at six minutes past 11?

Colonel GOETHALS. No, sir.

Mr. ESCH. Would it be within the range of possibility that the transmission of a wireless message at that station might have fired that premature shot—25 miles?

Colonel GOETHALS. I doubt it. That would be a question of induced current in the fuse itself, and it is the quantity of electricity and not the voltage necessary to fire the fuse. The quantity from the wireless would be too small.

Mr. ESCH. If there was a message being received or transmitted at six minutes past 11, would it be more than a coincidence?

Colonel GOETHALS. No; I do not think it would be anything more.

Mr. BARTLETT. Will you kindly make a statement about the nurses?

Colonel GOETHALS. The change in organization is toward concentration. Some of the doctors thought expenses could be reduced by concentrating everything at Ancon and using the Colon Hospital and the hospitals along the line as emergency hospitals and as rest camps. That was finally recommended by Colonel Gorgas after being thrashed out with his doctors, and I approved it. That caused a reduction in the number of nurses and the number of doctors, and the question came up how the reduction should be made—whether length of service should be given first consideration, or efficiency only. I took the ground, and the doctors agreed with me, that where our health is concerned length of service should have nothing to do with it, but efficiency only should rule. That being decided upon, the doctors at each hospital and the head nurse each prepared a list of nurses according to their relative efficiency—and it is remarkable how closely their lists agreed. Then these lists were turned over to the Director of Hospitals, the chief sanitary officer, and the two superintendents; they arranged a consolidated list, and gave notification to the last ten on that list that their services would be dispensed with. It is hard for a nurse to understand that some other nurse is more efficient than she, and that the doctors have not some spite against her. But I have stuck to the recommendation of the doctors and based the reduction on efficiency alone.

Mr. BARTLETT. The demand for material from the States will increase from now on?

Colonel GOETHALS. Along certain lines, yes. If we have to discontinue the use of oil we will have to purchase large quantities of coal.

Mr. BARTLETT. There will be a large demand for cement?

Colonel GOETHALS. Yes. The cement we have already contracted for; that will begin to come down very soon in regular shipments, at a uniform rate.

Mr. KNOWLAND. There is no cement on the zone except what we bring in?

Colonel GOETHALS. No; only what we bring in. We have never favored the manufacture of cement on the Isthmus, because it takes a few years to find out whether you are getting a good article, and we do not care to take the risk.

Mr. KNOWLAND. If the Panama Railroad boats are not sufficient to bring material you will have to get other lines?

Colonel GOETHALS. Yes, sir. The Panama Railroad purchases all the coal and we purchase our coal from them; they have made contracts with the Earn Line and the Munson Line, both lines having opportunity of return cargo from Santiago, Cuba.

Mr. BARTLETT. Are they American bottoms?

Colonel GOETHALS. Those lines are owned by American capital I believe, but are of foreign register.

Mr. BARTLETT. Efforts to confine all shipments of material to American vessels would result in—

Colonel GOETHALS. It would increase the cost of our transportation about 5 per cent.

Mr. BARTLETT. How would it affect the matter of delaying or expediting the work here?

Colonel GOETHALS. I do not think, if our contracts were made for delivery, so as to provide a penalty as is now done, it would delay the delivery of material any more than the delays we now suffer. I do not see why it should. Conditions now, from what I understand, are different from what they were a year ago; there are more idle ships.

Mr. BARTLETT. How would it affect the shipment of material from southern ports, if the bill now before Congress should be enacted?

(At this point an informal discussion ensued in reference to the bill referred to, which provides that all supplies for the commission on the Isthmus must be shipped in American bottoms.)

Mr. BARTLETT. How would it affect the shipment of material from Galveston, New Orleans, and the other southern ports?

Colonel GOETHALS. I do not know. The New Orleans people, last year, claimed it would seriously affect them. It would affect our supplies in cold storage from New Orleans very materially.

Mr. BARTLETT. In reference to the employment of skilled labor—the employment of foreign people upon work that is called skilled labor, such as firemen or engineers?

Colonel GOETHALS. We are required by an executive order issued in February last to employ none but American citizens for positions on the "gold roll"—which is practically the skilled labor—except when an American citizen is not found competent or available to do that work; so that we have restricted our employments to American citizens so far as possible. In the cases of the engineers that you mention, those men have been employed running switching engines for several years. The Panama Railroad employs colored engineers for running some of their switch engines. They are foreign negroes—from the West Indies.

Mr. HUBBARD. Have you given consideration to the organization of the courts in the zone with reference to present and probable future conditions?

Colonel GOETHALS. Not to any extent. I do not believe the circuit judges are overworked, and handle relatively few cases compared with the district judges.

Mr. BARTLETT. Are there American citizens here from whom juries could be drawn?

Colonel GOETHALS. Yes; but I am opposed, personally, to jury trial on the Isthmus. I am a firm believer on this job in summary justice. Juries can be obtained, but not without interference with the work.

Mr. BARTLETT. That is so everywhere?

Colonel GOETHALS. But here it tells more than anywhere else, for we can not replace our men easily.

Mr. BARTLETT. Have you ever had any complaint in reference to severity in the administration of the laws?

Colonel GOETHALS. No.

Mr. KENNEDY. After the canal is completed, do you anticipate a large population on the zone?

Colonel GOETHALS. I think there will be. To my mind the land bordering the lake will be valuable property.

Mr. KENNEDY. But there will be no great commercial business carried on outside of the transportation problem in the zone?

Colonel GOETHALS. I look for machine shops and supply depots at both ends of the canal.

Mr. KENNEDY. Do you think the locks, after they are completed, ought to be policed?

Colonel GOETHALS. They must be policed, especially in times of trouble; but as for any one man getting in with a stick of dynamite and doing any damage, that is just one of the scares of the press.

Mr. CUSHMAN. What would be the amount of damage, Colonel, created by one or two sticks of dynamite exploded on the locks?

Colonel GOETHALS. None whatever, except to blow out a little concrete; there would be no other damage. I do not anticipate that any damage could be done unless they should get at the maneuvering gear of the lock gates; and of course a man would be under suspicion as soon as he got near the gates.

Mr. ESCH. What use will there be for the Panama Railroad after the canal is completed?

Colonel GOETHALS. I think there will be a great many split cargoes; that is, ships will discharge part of their cargoes at either end of the canal for transshipment to the other side.

Mr. STEVENS. You are the chairman of the commission and the head of the civil administration of the zone?

Colonel GOETHALS. I am during the absence of Senator Blackburn. I have taken over his duties while he is away so as to get in closer touch with the details of that department.

Mr. STEVENS. As we understand it, the civil work of administration is subordinate to the engineering work?

Colonel GOETHALS. That is the way I understand it.

Mr. STEVENS. Is there any difference that you can discern between authority exercised in that way upon act of Congress, or that would be exercised by virtue of the President acting as he does now?

Colonel GOETHALS. No, sir. I am inclined to believe the present method is better for the reason that we can get quicker results.

Mr. STEVENS. If you depended on congressional action for the details of law; but you did not have in mind as to whether Congress should delegate to the President the exact authority he has now.

Colonel GOETHALS. No; it is only a question of the laws applicable to the Canal Zone.

Mr. STEVENS. Have you made any recommendation or given any thought to the question of administrative organization as being different from what it is now?

Colonel GOETHALS. No, sir.

Mr. STEVENS. You are satisfied it is efficiently conducted under the present scheme?

Colonel GOETHALS. I think so.

Mr. STEVENS. You consider, then, it is necessary for efficient construction that the chairman of the commission should be superior in authority to all other authority of the zone?

Colonel GOETHALS. I do not see how we are going to operate here unless some one is vested with authority to step in and decide questions.

Mr. STEVENS. If you have any other official coordinating authority, or superior in any other branch in the zone, would it lead to conflict?

Colonel GOETHALS. It did prior to my coming, and I presume it would while I remain here.

Mr. STEVENS. So that, for efficient construction, it is necessary for one official to have paramount authority over all departments of the government?

Colonel GOETHALS. Yes, sir. Under the last executive order the commission is placed more in the position of an advisory body to the chairman, excepting in certain questions.

Mr. STEVENS. Then, as a matter of practical working, the commission is subordinate to the chairman?

Colonel GOETHALS. Yes, sir.

Mr. STEVENS. You stated that you thought it would be wise to sell the public lands upon the zone. Would it not be wise to wait until the completion of the canal, and see what could be done at that time, before Congress attempts to finally dispose of the public lands of the zone?

Colonel GOETHALS. That probably would be the better way, because the Government might want to reserve certain tracts, which we can not foresee now.

Mr. STEVENS. And would it not be wise, also, to make such leases on such terms as would attract an agricultural population as soon as possible, with the idea of finally disposing of the matter, when the lands in the zone and the canal are ready to be considered for their long operation and government?

Colonel GOETHALS. I think that whole question of government should be postponed—and that would also involve the question of lands—until the canal is nearly completed.

Mr. STEVENS. By that question of government you do not mean the ultimate source—

Colonel GOETHALS. No, no; I mean the local regulations.

Mr. STEVENS. As a matter of fact, the President and the Secretary of War have reported in favor of legislation so that the authority to

run this government would emanate from Congress, rather than from the President, but the local regulations should be adopted by the authorities on the ground.

Colonel GOETHALS. Yes, sir.

Mr. KENNEDY. You have five district judges. The population of the zone is approximately what?

Colonel GOETHALS. I think about 60,000.

Mr. BISHOP. According to the last census, the population of the zone is 53,000—the population is 50,003. It is given on page 412 of the census report.

Mr. HUBBARD. On what date was that taken?

Mr. BISHOP. It was begun March 3 and completed June 23 of last year.

Mr. BARTLETT (to Colonel Goethals). I would like to ask one question in regard to the area of this lake. When the dam is completed the water of it will extend to lands beyond the jurisdiction of the United States, will it not, so far as ownership is concerned—in other words, will extend into Panama? I understand we have a right under the treaty to take these lands?

Colonel GOETHALS. Yes.

Mr. BARTLETT. Ought not some provision be made for the punishment of people who would undertake to injure the land or divert the water?

Colonel GOETHALS. I do not think there is any danger of diverting the water from the lake in these stretches, but I think the Government of the United States should have control and jurisdiction over all parts of the lake.

Mr. RICHARDSON. Is that not one of the rights we purchased?

Colonel GOETHALS. We have the right to take the land for canal purposes, yet we have no jurisdiction beyond the 5-mile limit; that is where the difficulty lies; we have the question up now with the State Department with regard to the jurisdiction at Porto Bello. We are securing stone on an island across the bay from the town. We want to extend our police jurisdiction, as the Panamanian police are practically helpless, but the Panamanian Government will not authorize it. What they have authorized now is the turning over of some of our police force to them, and they propose that these police act under their lieutenant of police, but we are trying to get jurisdiction so that we can maintain our police.

Mr. BARTLETT. You might acquire land and offenses might be committed in the waters of our lake beyond the line?

Colonel GOETHALS. That is true, and we would not have jurisdiction, but the Panamanian Government would. That is where the difficulty would come, with liability of friction.

Mr. HUBBARD. Have not indications come to your knowledge of mineral deposits of value, gas or oil, in the Canal Zone?

Colonel GOETHALS. No. There is an employee who feels pretty sure there is oil within our limits, but he has not been able to locate it. Then, a company was organized from the Bellingham Bay section of Washington, claiming that they had found valuable deposits of gold within the zone.

Mr. HUBBARD. Are such deposits known to exist on the Isthmus anywhere?

Colonel GOETHALS. Not that I know of.

Mr. STEVENS. Under the treaty, has not the United States the right to police portions of the Republic of Panama if the Republic is not able to do it itself, if such policing is necessary for the construction of the canal?

Colonel GOETHALS. The Panamanian Government claims that we have not.

Mr. STEVENS. Do they claim that such a right is confined to the cities of Panama and Colon, or do they claim that it does not exist?

Colonel GOETHALS. That it does not exist. That question has been taken up with the State Department, and it is there now.

Mr. STEVENS. You have the right to go upon Panamanian territory for the purpose of doing work necessary for the construction of the canal?

Colonel GOETHALS. That has never been questioned, and we are now at Porto Bello preparing for the excavation of necessary material.

Mr. STEVENS. Have you not a right to properly care for the property you occupy at Porto Bello?

Colonel GOETHALS. That has never been questioned.

Mr. STEVENS. But police privileges there have been denied us?

Colonel GOETHALS. Yes; the right of establishing our own police force has been denied. They are perfectly willing to give us police protection, but when they make arrests our Spaniards either rescue the prisoners or go over to the prison and take the men out. We can not maintain order under these circumstances.

Mr. STEVENS. In the administration of law has it come to your attention that there is a difficulty in that the treaties relating to extradition of people accused of crime committed in the United States did not extend to the zone?

Colonel GOETHALS. There is no extradition treaty between Panama and the zone. There was an agreement between Governor Magoon and the Panamanian secretary of foreign affairs providing for the extradition of accused persons, and we have lived up to it, but it is an agreement made between parties who had no right to make a treaty agreement.

Mr. STEVENS. And it can not be enforced?

Colonel GOETHALS. No; and the question came up the other day, when an American shot a negro on Panamanian soil. He was arrested on zone territory. They asked for extradition, and I referred the matter to Washington. I was directed by the Secretary of War to turn the man over quietly, but I was advised at the same time that this was not to be considered as a precedent. It was stated in this agreement between Governor Magoon and the Panamanian authorities that the extradition from the zone to the Panamanian authorities of an American citizen was left to the option of the governor. We can not afford to have our people committing murders in Panamanian territory and taking refuge in the Canal Zone.

Mr. STEVENS. So there is need of legislation?

Colonel GOETHALS. Yes; there is need of legislation, and an extradition treaty for that purpose.

Mr. BARTLETT. Is that the case of the man who killed another at Colon?

Colonel GOETHALS. No. It is the case of the corral master at Ancon who shot a negro, who did not die, although they thought at first he would. He followed the negro into Panamanian territory,

after a quarrel at the corral, and shot him after crossing the line, and the corral master was arrested in zone territory.

Mr. STEVENS. Have you had any experience, or has it come to your attention, how long a lease of agricultural land would be necessary in order to insure a good class of people coming here and improving that land sufficiently to raise provisions?

Colonel GOETHALS. I have not discussed that question in connection with the Canal Zone land, but only in connection with railway lands in Panama and Colon, and I believe a longer lease would be better, that more substantial buildings may be erected.

Mr. STEVENS. About what time do you think these leases should run?

Colonel GOETHALS. After discussing the matter with the Secretary of War we agreed that twenty-five years should be the maximum lease and five years the minimum limit.

Mr. STEVENS. Is there not a limitation as to the amount of land to be occupied thus?

Colonel GOETHALS. In the case of the Panama Railroad Company's lands, they are building lots only for house purposes.

Mr. STEVENS. Mr. Esch wants to ask a question or two.

Mr. ESCH. I guess I've asked all I care to.

Mr. BARTLETT. Without serious interference with the work by changes of plans, and in case of the necessary funds being furnished by Congress, when can we reasonably expect the work to be completed?

Colonel GOETHALS. The minority of the board of consulting engineers practically fixed January 1, 1915, for the time of the completion of the lock type of canal, and we see no reason why we should not complete the canal within that time.

Mr. STEVENS. Colonel, will you please continue your statement regarding the probable use of the Panama Railroad after the completion of the canal?

Colonel GOETHALS. We are going to rebuild the railroad in its new location, both for construction purposes and for commercial purposes. I have always been of the opinion that the commercial value of the railroad will enhance, because ships will come down or up the coasts with cargoes, parts of which will be destined for ports on the other coast, and I anticipate a splitting of cargoes and the transshipment of these cargoes to the other side by the railroad.

Mr. STEVENS. Could it not be done by small boats?

Colonel GOETHALS. It could, but the railroad is a necessity for purposes of supply and of maintenance, and it will probably be cheaper to maintain and operate than boats.

Mr. RICHARDSON. You have indicated, then, within what time it can be completed, but you have not given a statement of what it will cost?

Colonel GOETHALS. No; I have not given that.

Mr. RICHARDSON. Are you prepared to give that?

Colonel GOETHALS. I am prepared, but I would ask to be excused, because I do not want the question to come up in the press. I have that statement in my office, prepared for submission to the Secretary of War and transmission to Congress, and I promised to have it before this session. Then this furore came up, and I concluded that I would hold it.

Mr. RICHARDSON. Do you know what the estimate was of the cost of the canal that was made at the beginning?

Colonel GOETHALS. Yes; the consulting board of engineers, if my memory serves me right, estimated that it would cost \$139,000,000. We will exceed that.

Mr. RICHARDSON. What amount has been already expended?

Colonel GOETHALS. The consulting board made estimates on the basis of the construction of the canal, exclusive of the cost of sanitation and civil government. Taking the expenditures on the basis of the estimates, on the 1st of last July we had expended about \$85,000,000 on the construction of the canal.

Mr. RICHARDSON. What proportion of the work of finishing the canal has been completed?

Colonel GOETHALS. It is impossible to state, because we can not form an estimate of the percentage of the work done at the Gatun dam, nor the percentage of the locks that have been completed. We can only state that the excavation of the top locks has been practically done, leaving half of the middle and practically all of the lower locks to be done. It would not be possible to give a percentage of the work done, as it is so scattered, and much of it so largely of a preparatory nature so far as the locks and dams are concerned.

Mr. RICHARDSON. Do you believe the cost will exceed the original estimate made?

Colonel GOETHALS. I know it will.

Mr. HUBBARD. Have you considered the desirability of the Department of Agriculture establishing experimental stations here?

Colonel GOETHALS. I have always believed it should be done, and the question was taken up about a year and a half ago, and it was learned that such stations could not be established without a specific appropriation by Congress.

Mr. RICHARDSON. Colonel, were you advised by anyone not to state an estimate of the cost of the canal; you said you did not want to do it on account of the press.

Colonel GOETHALS. There is a representative of the press here, and I do not care to have the matter made public and discussed at this time.

The CHAIRMAN. That was not the question asked. Mr. Richardson merely asked if anyone had advised you not to make a statement.

Colonel GOETHALS. No, sir; it is personal. It would have been published before you came here if this question of the dam had not come up, and I thought that I had better hold it until the engineers reported on the project. Some of our particular friends in the States are going to be duly shocked and horrified, according to the press accounts.

Mr. HUBBARD. And you do not wish to do it too soon?

Colonel GOETHALS. No; they have had enough shocks in regard to the Gatun dam slipping down.

The CHAIRMAN. Have we any more witnesses?

Mr. STEVENS. I think not, Mr. Chairman.

The CHAIRMAN. Then the committee will adjourn, subject to the call of the chairman.

RESOLUTIONS ADOPTED AT A MASS MEETING HELD IN Y. M. C. A. CLUBHOUSE, GORGONA, ON THE EVENING OF JANUARY 6 TO PROTEST AGAINST THE CURTAILMENT OF OPERATION OF COMMISSARIES.

Whereas it has come to our notice that certain merchants in the cities of Panama and Colon, Republic of Panama, are circulating for signature a memorial addressed to the President of the United States, in which, among other things, it is asked:

1. That the commissary stores should import only such articles as are sold in the post canteens in the United States;
2. That the commissary stores should sell merchandise only to the employees of the United States, and only victuals to the employees of the Panama Railroad;
3. That the Isthmian Canal Commission should not be permitted directly or otherwise to enter into competition with native enterprises.

And whereas it is apparent that if this preposterous request of the Panama merchants be complied with by the President of the United States there would take place a large curtailment of what is now known as "commissary privileges," and an unnecessary and humiliating hardship forced upon the American employees of the Isthmian Canal Commission and Panama Railroad.

And whereas it is obvious that the request "that the Isthmian Canal Commission should not be permitted to enter into competition with native enterprises" is interpreted to mean the abolishing of the commissary bakery, laundry, ice plant, and other departments that have long been looked upon as necessities by the American employees.

And whereas the successful accomplishment of the demands of the Panama merchants means that the American residents of the city of Gorgona and other towns similarly situated will be almost wholly dependent upon Chinese merchants for the purchase of a large amount of goods that are considered necessary in the average American home.

And whereas past and present experience regarding prices and quality of merchandise handled by the merchants of the Isthmus of Panama has forced the American employees to the logical conclusion that the continuance of the operation of the several departments of the commissary, without change, is essential to their continued physical well-being, contentment, efficiency, and retention of self-respect.

And whereas it is perfectly obvious that the proposals of the Panama merchants are made solely toward the end of enriching themselves at the expense of the American employees of the Isthmian Canal Commission and Panama Railroad.

And whereas it is and has been an undisputed fact that the commissary department of the Isthmian Canal Commission is an inherent and essential part of the organization now being used for the construction of the Panama Canal.

And whereas it would be a physical impossibility for any native concern of less magnitude than the Panama Railroad to maintain an efficient organization which could satisfactorily supply the employees of the Isthmian Canal Commission and Panama Railroad residing along the line of the work with the comforts and necessities that they are now enjoying.

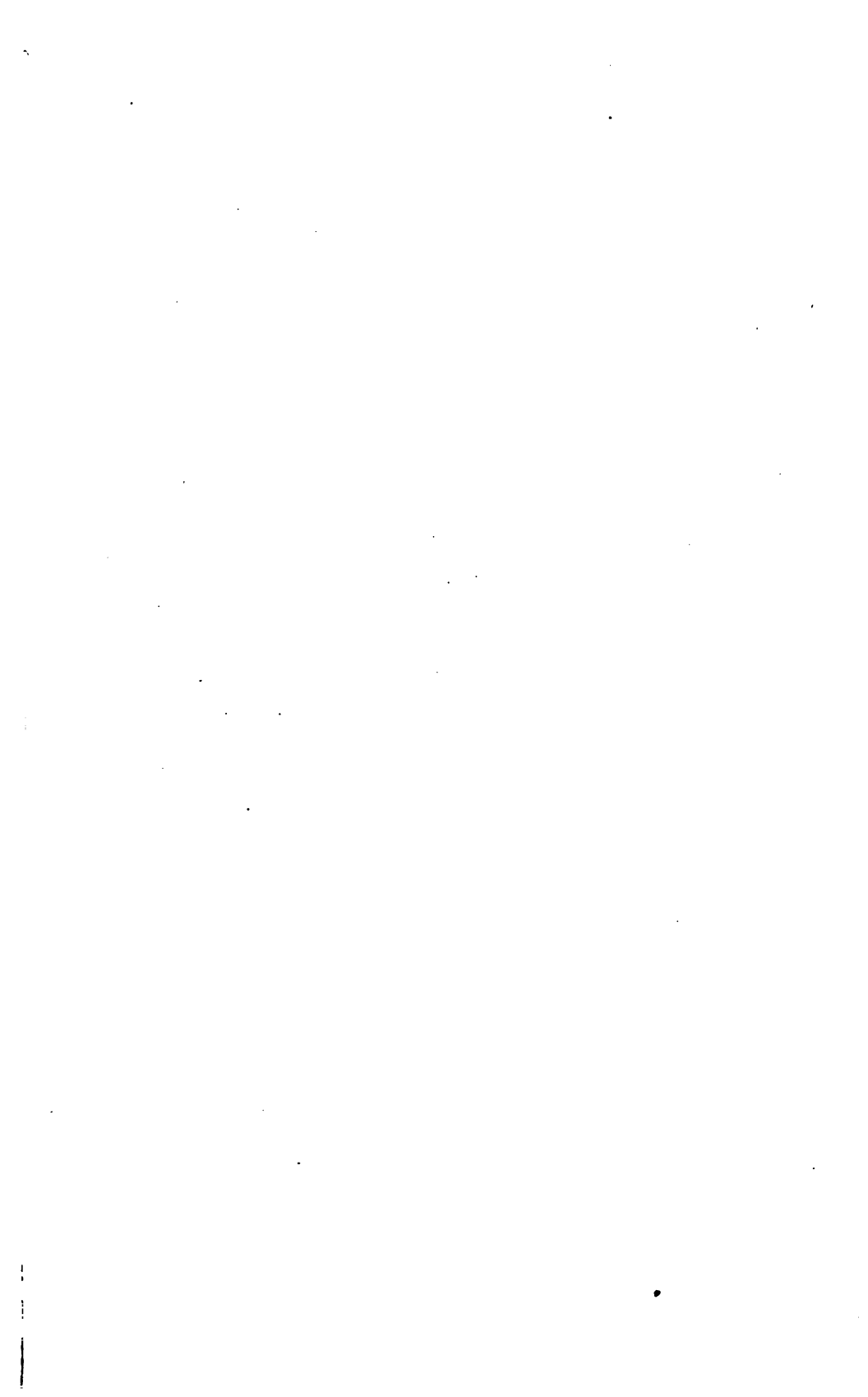
And whereas the answer given by ex-Governor Charles Magoon to the Panama merchants in 1905 in which he said "that no country could justify themselves in bringing an army of several thousand men into a strange country without making broad and comprehensive plans for their subsistence and clothing," still holds good and is as unanswerable to-day as it was three and one-half years ago: Now therefore

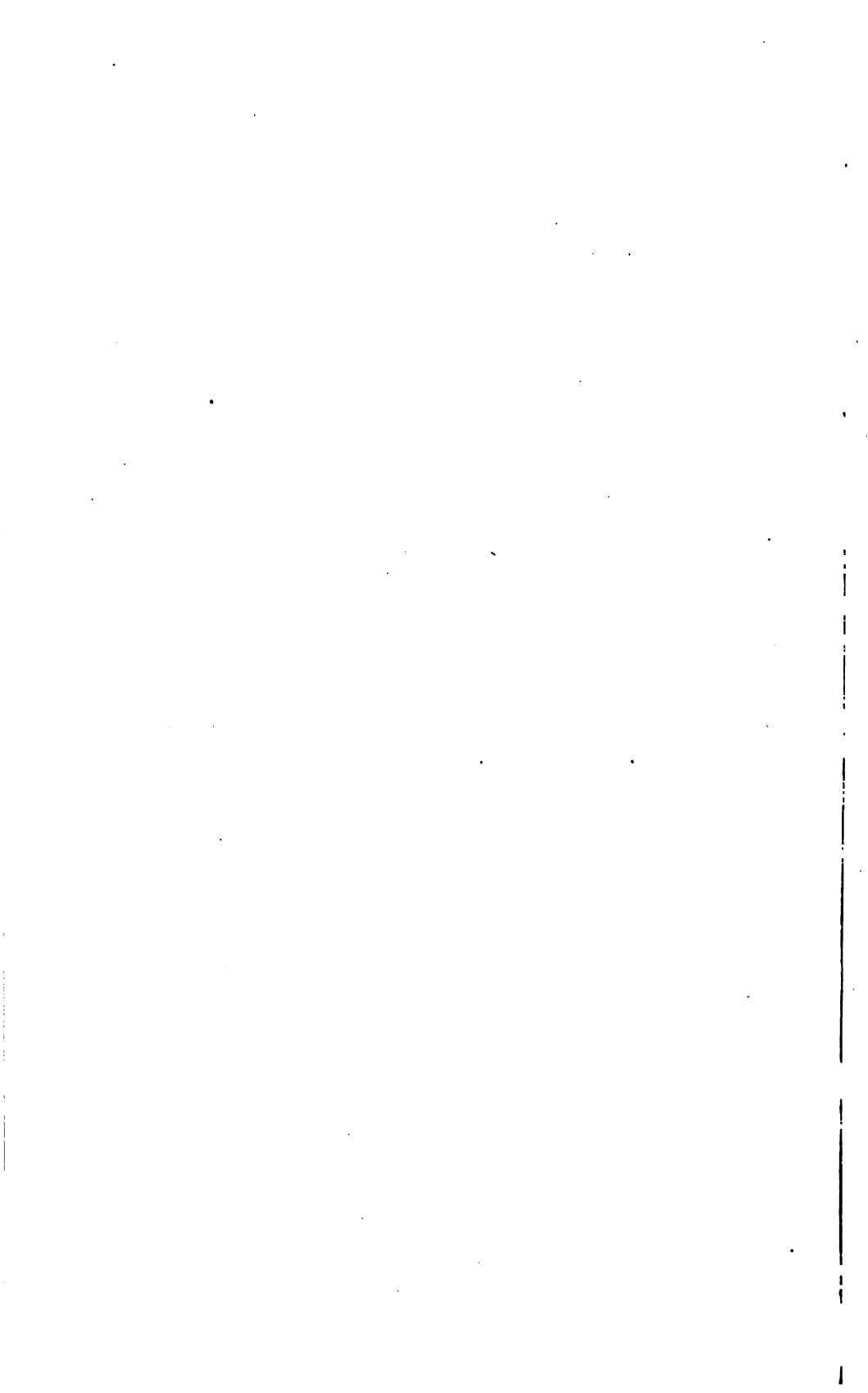
Be it resolved, By the employees of the Isthmian Canal Commission and Panama Railroad resident in Gorgona that we protest emphatically against any action that will tend to curtail in any way, shape, or manner the commissary privileges now enjoyed by the American employees of the Isthmian Canal Commission and Panama Railroad.

Be it further resolved, That in the opinion of the Americans present at this meeting that the time is now ripe and opportune to settle for all time this agitation against commissaries which dates back three and one-half years and which has been productive of nothing save more or less ill feeling, which all Americans on the Isthmus would be pleased to see eradicated.

The resolutions were put to a vote and were unanimously carried. Meeting was adjourned.

Mr. C. L. PRENTIS, *Storekeeper, Gorgona*,
 Mr. E. M. ROBINSON, *District Tax Collector, Gorgona*,
 Mr. FRANK MORRISON, *Gorgona Shops, Gorgona*,
 Mr. C. R. GEDDES, *Engineer Corps, Gorgona*,
 Mr. A. B. CORROTHERS, *Gorgona Shops, Gorgona*,
Members of the Committee on Resolutions.







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